A collection of pyrotechnic compositions

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Introduction, disclaimer, credits and notes on this document

Introduction

This book is a compilation of all the compositions I have found on the net up to this date. It is far from complete, and is updated quite often. If you find anything that you feel should be added, changed, deleted or properly credited, please let me know. I can be reached at wfvisser@dds.nl.

Disclaimer

Credits

Many people on the net have provided, knowingly or not, much of the information that went into making this document. Whenever possible, I tried to include the name and address of the poster of the composition and a short reference to the literature it originated from. It was not always possible for me to trace a composition back to its original source, and if you feel anything should be more properly credited or removed or if your

adress or name is spelled incorrectly or is outdated, please let me know.

Important note

Note that I have tried to give a short comment on the most obvious safety aspects of these mixtures, but have been inconsistent in doing so. I also left out most of the details and the standard precautions that should be taken during preperation and handling of the mixture or its components. Procedures for safe mixing and other operations are considered known, and so is knowledge of combinations of chemicals that should never be used. The list does contain several dangerously sensitive mixtures. It is a must to obtain additonal information from reliable sources on the safety of any of these compositions before experimenting with any of them.

General notes

All parts are by weight. The abbreviation 'qs', which is sometimes used, stands for 'quantity sufficient'. In these cases the required amount is not very critical, and with some experience it is not hard to guess how much should be used. Additional percentages are given as '+x%', where the x% is a percentage of the total weight of the other chemicals. Sometimes compostions must be stabilised: Magnesium or magnalium must always be treated with potassium dichromate. Iron must always be coated with tung- or linseed oil. To all compositions containing both nitrates and aluminum an additional +1% boric acid must be added. Compositions containing both sulfur and chlorates or copperammonium complex salts in combination with nitrates or chlorates are extremely sensitive and should never be used. Compositions containing aluminium or magnesium incombination with nitrates and chlorates should also never be used.

Last updated: august, 1998

Chapter 1: Rocket propellants

Rocket propellant #1 ('Candy Propellant')
Source: rec.pyrotechnics
Comments: This propellant is often refferred to as "candy propellant".
Preparation: It is best prepared by melting the potassium nitrate and sugar together, but this is a dangerous operation and could result in accidential ignition during preperation. Dry mixing is possible and much safer but produces lower quality propellant.

Potassium nitrate.....74.5
Sugar.....25.5

Rocket propellant #2
Source: rec.pyrotechnics
Comments: The propellant has a burn rate of 0.0385 inch/sec at 100psi and a burn rate of 0.04 inch/sec at 300psi. Burn temperature is approx. 1800K. and ISP=180.
Preparation:

Ammonium nitrate.....85-90%
Elastomeric binder (HTPB or other urethane plastic).....?

Rocket propellant #3
Source: rec.pyrotechnics
Comments: Stinks like ammonia when mixed, and hardens faster than normal epoxy curing time. Suggestions for rocket dimensions: 1" rocket tube, 3" fuel length, Durhanm’s water putty nozzle 3/8" thick, and 5/16" diameter. Core in center of fuel about 3/8" diameter through the length.
Preparation:

Ammonium perchlorate, 200 micron.....80
Resin (Epon 815 epoxy & curing agent U).....20

Copper chromite.....+1%

Rocket propellant #4
Source: Composition from the text ‘The Incredible Five Cent Sugar Rocket’ distrubuted on the internet by the Teleflite corporation.
Comments: Mixture is somewhat hygroscopic. Low impulse propellant.
Preparation:

Potassium nitrate.....63
Sugar.....27
Sulfur.....10

Rocket propellant #5 (Whistling)
Source: rec.pyrotechnics archive. Article by A.J. Smith
Comments: Loud whistling rockets can be made with this. The author of the text this composition was taken from used it in nozzle-less whistling rockets. The rocket casings were 3/4 inch inner diameter, and 3.25 inch length. The fuel grain ended 1/8" from the rear end of the motor tube.
Preparation: 1. Mix the iron oxide with the potassium benzoate and mill this mixture untill a very fine powder is obtained. 2. Melt the petroleum jelly in a beaker on low heat. Turn the hot plate or stove off. Make sure no sources of heat or sparks are present before proceeding with the next steps. 3. While stirring, add 5 parts of toluene to each part of petroleum jelly by weight. Laquer thinner can be substituted for toluene when pure toluene is not available. Continue stirring untill the petroleum jelly has completely dissolved in the solvent used. 4. Add the petroleum jelly to the potassium benzoate/iron oxide mix and stir the mixture untill it becomes homogenous. 5. Then, slowly add the potassium perchlorate while stirring continuesly with a wooden spoon for several minutes until homogenous. At this point, the mixture usually has a consistency of thick soup and the beaker is warm to the touch. If the mixture seems too dry or thick, extra toluene or laquer thinner can be added at this stage. 6. Spread the composition out in a layer about 1/2" thick on kraft paper over newspapers to dry overnight. It is important that the mixture has thoroughly dried before pressing motors. A slightly damp mix can cause some shrinkage of the propellant grain over a period of days or weeks, causing the rocket to explode when ignited. 7. When the composition has dried overnight, carefully run the mixture through a 20 mesh sieve twice and store in a paper container so that trace amounts of solvent can evaporate. After several days, the mix is ready to press.

Potassium perchlorate (fine mesh).....64
Potassium benzoate.....32
Red Iron Oxide, Fe2O3.....1
Petroleum jelly.....3

Rocket propellant #6 (KNO3 propellant)
Source: rec.pyrotechnics. Posted by Chris Beauregard <cpbeaure@descartes.waterloo.edu
Comments: The burning rate of these rocket fuels depends much less on pressure than that of black powder. This widens the accetable limits of the ratio nozzle area/fuel surface area.
Preparation:

Potassium nitrate.....72
Carbon.....24
Sulfur.....4

Rocket propellant #7 (NaNO3 propellant)
Source: rec.pyrotechnics. Posted by Chris Beauregard <cpbeaure@descartes.waterloo.edu
Comments: The burning rate of this rocket fuels depends much less on pressure than that of black powder. This widens the accetable limits of the ratio nozzle area/fuel surface area.
Preparation:

Sodium nitrate.....69
Carbon.....27
Sulfur.....4

Rocket propellant #7 (Zinc/Sulfur)
Source: rec.pyrotechnics
Comments: Burns very fast, producing lots of smoke. It is not a very effective propellant due to its low energy density.

Preparation:

Zinc.....67.1%
Sulfur.....32.9%

Space Shuttle Boosters propellant
Source: NASA homepage
Comments:
Preparation:

Aluminum powder.....16
Ammonium perchlorate.....69.9
Fe2O3 catalyst.....0.07
Rubber based binder of polybutadiëne acrylic acidacrylonitrile.....12.04
Epoxy curing agent.....1.96

ESTES C-class rocket engine propellant
Source: rec.pyrotechnics, Composition from 1994 US Dept. of Labour Material Safety Data Sheet.
Comments:
Preparation:

Potassium nitrate.....71.79
Sulfur.....13.45
Charcoal.....13.81
Dextrin.....0.95

Blue strobe rocket propellant
Source: Greg Gallacci <psygreg@u.washington.edu
Comments: The GE silicone II is noted for having an ammonia-like odor, where the GE silicones smell more like vinegar. The dimensions of the rocket made with this propellant were 1 1/8 inch ID, with a 1/2 inch core.
Preparation: Mix the copper oxide, PVC and silicone first, in a plastic bag. Then mix in the ammonium perchlorate. The stuff is said to be somewhat crumbly, and presses well.

Ammonium perchlorate.....63
Silicone II.....22
Copper(II)oxide.....10
PVC.....5

Chapter 2: Fountain, gerb and bengal fire compositions

Fountain #1
Source: rec.pyrotechnics
Comments:
Preparation:

Barium nitrate.....45
Potassium nitrate.....5
Meal powder.....5
Aluminum.....45

Fountain #2

Source: rec.pyrotechnics
Comments:
Preparation:

Meal powder.....72
Potassium nitrate.....7
Charcoal.....7
Dark Aluminum.....7
Aluminum (-80/+120).....7

Fountain #3
Source: rec.pyrotechnics. Posted by Tom Perigrin <tip@lead.aichem.arizona.edu
Comments:
Preparation: Charcoal, sulfur and potassium nitrate are ball milled and very fine. Iron is medium coarse. After mixing (by diaper method), add an equal weight of course meal powder (about 1Fg to 2Fg equivalent), and mix that in too.

Potassium nitrate.....50
Charcoal.....10
Sulfur.....15
Iron.....25

Fountain #4
Source: Shimizu[1], page 127
Comments: This mixture was used in the fountains on the cover of the book. The metal powder can be either aluminum, magnalium or titanium.
Preparation:

Black powder, finely powdered.....70
Pine charcoal.....4
Metal powder.....26

Fountain #5
Source: Homepage of Tom Peregrin <tip@lead.aichem.arizona.edu
Comments:
Preparation:

Potassium nitrate.....24
Charcoal.....4
Sulfur.....4
Iron.....10

Fountain #6
Source: Homepage of Tom Peregrin <tip@lead.aichem.arizona.edu
Comments:
Preparation:

Potassium nitrate.....2
Charcoal.....41
Sulfur.....1
Iron.....1
Meal Powder.....6

Fountain #7
Source: Homepage of Tom Peregrin <tip@lead.aichem.arizona.edu
Comments:
Preparation:

Potassium nitrate.....2
Charcoal.....4
Iron.....2
Meal Powder.....4

Fountain #8
Source: Homepage of Tom Peregrin <tip@lead.aichem.arizona.edu
Comments:
Preparation:

Potassium nitrate.....8
Sulfur.....3
Sb2S3.....1
Meal Powder.....2

Fountain #9
Source: Homepage of Tom Peregrin <tip@lead.aichem.arizona.edu
Comments:
Preparation:

Sb2S3.....8
Aluminum.....4
Meal Powder.....40

Fountain #10
Source: Homepage of Tom Peregrin <tip@lead.aichem.arizona.edu
Comments:
Preparation:

Sb2S3.....9
Dextrin.....4
Sodium oxalate.....6
Meal Powder.....40

Fountain #11
Source: Homepage of Tom Peregrin <tip@lead.aichem.arizona.edu
Comments:
Preparation:

Potassium nitrate.....3
Charcoal.....1
Sulfur.....1
Aluminum.....1
Meal powder.....2

Blue fountain
Source: rec.pyrotechnics, posted by EFFECTS <effects@aol.com
Comments:
Preparation: Granulate the mixture with a small amount of alcohol. Let dry and press into tubes. Very slowly burning mixture. Don’t substitute shellac with red gum.

Ammonium perchlorate.....7
Stearin.....2

Copper(II)oxide.....1
Shellac.....0.5

Gerb #1
Source: rec.pyrotechnics
Comments:
Preparation:

Meal powder.....73
Iron (60 mesh).....27

Gerb #2
Source: rec.pyrotechnics
Comments:
Preparation: The iron must be treated with linseed or tung oil.

Meal powder.....4
Charcoal fines.....1
Steel fillings.....2

Bengal fire #1
Source: Chemical abstracts[14] 122, 595944
Comments: Improved color, larger sparks and increased scatter radius for sparks.
Preparation:

Zr.....2-5
Cast iron shot.....18-23
Fe powder.....20-25
Al powder.....2-5
Corn dextrin binder.....3-6
Potato starch binder.....0.5-1.5
Barium nitrate.....balance

Bengal fire #2
Source: Chemical abstracts[14] 122, 59595
Comments: Increased combustion time
Preparation:

di-Buphtalate.....3-5
Fe-powder.....20-29
Al-powder.....4-7
Polyvinylbutyral binder.....11-17
NH4NO3 inhibitor.....1-4
Ammonium perchlorate.....balance

Green bengal fire #1
Source: rec.pyrotechnics. Posted by Sweden <sweden@synchron.ct.se
Comments:
Preparation:

Barium nitrate.....80
PVC.....10
Red Gum.....10

Green Bengal fire #2
Source: "Mengen en Roeren"[6] , page 223
Comments:
Preparation:

Barium chlorate.....90
Shellac.....10

Green Bengal fire #3
Source: "Mengen en Roeren"[6] , page 223
Comments:
Preparation:

Barium chlorate.....23
Barium nitrate.....59
Potassium chlorate.....6
Shellac.....10
Stearic acid.....1

Green Bengal fire #4
Source: "Mengen en Roeren"[6] , page 223.
Comments: Burns nice and slowly leaving little residue, but not with a green color.
Preparation:

Barium nitrate.....6
Potassium nitrate.....3
Sulfur.....2

Blue Bengal fire #1
Source: "Mengen en Roeren"[6] , page 223.
Comments: This is a dangerous mixture since it contains a copperammonium complex and a chlorate.
Preparation:

Potassium chlorate.....6
Copper ammonium sulphate.....8
Shellac.....1
Willow charcoal.....2

Blue Bengal fire #2
Source: "Mengen en Roeren"[6] , page 223.
Comments: Burns moderately fast with a blueish-white color.
Preparation:

Potassium chlorate.....40
Copper sulphate.....8
Colophonium.....6

Chapter 3: Colored fire compositions, flares and torches

Blue fire composition #1
Source: rec.pyrotechnics. post by Pierre de Reuck <pierre@icon.co.za

Comments: Dangerous mixture,since it contains both a nitrate and a chlorate with a copper ammonium compound and also a combination of chlorate with sulfur.
Preparation:

Sulfur.....15
Potassium sulphate.....15
Cupric ammonia sulphate.....15
Potassium nitrate.....27
Potassium chlorate.....28

Blue fire composition #2
Source: rec.pyrotechnics
Comments:
Preparation:

Copper ammonium chloride.....5
Potassium perchlorate.....24
Stearin.....2
Asphaltum.....1

Blue fire composition #3
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains sulfur and a chlorate.
Preparation:

Potassium chlorate.....7
Copper(II)sulfide.....2
Sulfur.....4

Blue fire composition #4
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Potassium nitrate.....1
Copper(II)oxide.....1
Hg2Cl2.....1
Charcoal.....1

Blue fire composition #5
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Potassium nitrate.....12
Sulfur.....4
Sb2S3.....2

Blue fire composition #6
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Potassium nitrate.....7.5

Potassium chlorate.....14
Potassium sulfate.....7
Sulfur.....7

Blue fire composition #7
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Potassium chlorate.....8
Copper sulfate.....5
Shellac powder.....3
Sulfur.....7
Hg2Cl2.....4

Red fire composition #1
Source: "Mengen en Roeren"[6], page 223.
Comments: Burns at a moderate rate with a nice deep red color.
Preparation:

Strontium nitrate.....66
Potassium chlorate.....25
Powdered shellac.....9

Red fire composition #2
Source: "Mengen en Roeren"[6], page 223.
Comments:
Preparation:

Strontium carbonate.....16
Potassium chlorate.....72
Powdered shellac.....12

Red fire composition #3
Source: "Mengen en Roeren"[6], page 223.
Comments:
Preparation:

Strontium nitrate.....4
Potassium chlorate.....12
Strontium carbonate.....3
Kauri powder.....5

Red fire composition #4
Source: "Mengen en Roeren"[6], page 223.
Comments:
Preparation: The vaseline/wood dust mixture is prepared by melting 6 parts vaseline and mixing in 8 parts wood dust.

Potassium perchlorate.....9
Strontium nitrate.....40
Sulfur.....11
Colophonium.....1
Sugar.....1
Antimony.....1/2
Vaseline/Wood dust.....20

Red fire composition #5
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Potassium chlorate.....2
Strontium nitrate.....5
Charcoal.....1
Sulfur.....1

Red fire composition #6
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Potassium chlorate.....1
Calcium carbonate.....11
Strontium nitrate.....11
Sulfur.....4
Charcoal.....1

Red fire composition #7
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Potassium chlorate.....29
Strontium carbonate.....6
Orange shellac powder.....5

Red fire composition #8
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Strontium nitrate.....4
Orange shellac powder.....1

Red fire composition #9
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Strontium nitrate.....4
Potassium chlorate.....13
Hg2Cl2.....4
Sulfur.....2.5
Shellac powder.....1
Charcoal.....1

Green fire composition #1
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.

Preparation:

Barium nitrate.....7
Potassium chlorate.....3
Sulfur.....2

Green fire composition #2
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Barium nitrate.....3
Potassium chlorate.....8
Sulfur.....3

Green fire composition #3
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Barium chlorate.....9
Orange shellac powder.....1

Green fire composition #4
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Burns at a moderate rate with a greenish white flame. Not very convincing green.
Preparation:

Barium nitrate.....3
Potassium chlorate.....4
Orange shellac powder.....1

Green fire composition #5
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Barium nitrate.....18
Potassium chlorate.....9
Sulfur.....4.5
Shellac powder.....1.5
Hg2Cl2.....3
Charcoal.....1.5

White fire composition #1
Source: "Mengen en Roeren"[6], page 223.
Comments:
Preparation:

Potassium nitrate.....24
Sulfur.....7
Charcoal.....1

White fire composition #2

Source: "Mengen en Roeren"[6], page 223.
Comments:
Preparation:

Potassium nitrate.....7
Sulfur.....2
Powdered antimony.....1

White fire composition #3
Source: "Mengen en Roeren"[6], page 223.
Comments:
Preparation:

Potassium perchlorate.....7
Barium nitrate.....34
Sulfur.....7
Powderd Aluminum.....10

White fire composition #1
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Potassium nitrate.....6
Sb2S3.....1
Sulfur.....1

White fire composition #2
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Potassium nitrate.....24
Charcoal.....1
Sulfur.....1

Yellow fire composition #1
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments:
Preparation:

Potassium nitrate.....4
Sulfur.....1
Charcoal.....2
Sodium chloride.....3

Yellow fire composition #2
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Potassium chlorate.....5
Sodium oxalate.....2
Potassium nitrate.....1

Charcoal.....2
Sulfur.....1

Yellow fire composition #3
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Potassium chlorate.....9
Sodium oxalate.....3
Sulfur.....3
Shellac.....1.5

Yellow fire composition #4
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Potassium chlorate.....8
Sulfur.....2
Sodium carbonate.....3

Purple fire composition
Source: rec.pyrotechnics. Composition from "Magic With Chemistry"[7], chapter "colored fires"
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation:

Copper sulfate.....1
Potassium chlorate.....1
Sulfur.....1

Magnesium flare #1
Source: rec.pyrotechnics. Composition from "Fireworks, Principles and Practice"[2]
Comments:
Preparation: Magnesium is corroded by some nitrates when damp. It is common practice to coat the magnesium before use. about 4% linseed oil, or some potassium dichromate can be used for that purpose.

Barium nitrate.....22.5
PVC.....13
Magnesium (grade 0).....35
Potassium perchlorate.....22.5
Polyester.....5

Magnesium flare #2
Source: Kirk-Otthmer technical encyclopedia[8], chapter 'Explosives and Propellants'.
Comments: Heat of reaction: 6.134 kJ/g, Gas volume: 74 cm3/g, ignition temperature: 640°C, impact sensitivity test: 19% of TNT
Preparation:

Sodium nitrate.....38
Magnesium.....50
Laminac.....5

Green torch #1
Source: rec.pyrotechnics

Comments: Note that calomel is a very toxic compound.
Preparation:

Barium chlorate.....5
Barium nitrate.....4
Shellac.....1
Calomel.....2

Green torch #2
Source: rec.pyrotechnics
Comments:
Preparation:

Barium nitrate.....5
potassium perchlorate.....6
K.D. Gum.....2
Sulfur.....3

Green torch #3
Source: rec.pyrotechnics
Comments: Dangerous mixture, since it contains both an ammonium compound and a chlorate.
Preparation:

Barium nitrate.....40
Potassium chlorate 1
K.D. Gum.....6
Ammonium chloride.....1

Blue torch #1
Source: rec.pyrotechnics
Comments: Note that calomel and Paris green are both very toxic compounds.
Preparation:

Potassium perchlorate.....5
Copper acetoarsenite (Paris Green).....2
Dextrin.....1
Calomel.....1

Blue torch #2
Source: rec.pyrotechnics
Comments: This mixture is incompatible with nitrates and chlorates due to the presence of a copper-ammonium compound.
Preparation: 'Sugar of milk' is lactose.

Potassium perchlorate.....24
Copper ammonium sulfate.....6
Sugar of milk.....2
Sulfur.....9

Blue torch #3
Source: rec.pyrotechnics
Comments: This mixture is incompatible with nitrates and chlorates due to the presence of a copper-ammonium compound.
Preparation:

Potassium perchlorate.....24

Copper ammonium chloride.....6
Stearin.....2
Asphaltum.....1

Purple torch #1
Source: rec.pyrotechnics
Comments: Note that calomel is very toxic.
Preparation:

Strontium nitrate.....7
Potassium perchlorate.....9
Copper(II)oxide.....6
Calomel.....3
Sulfur.....5

Amber torch
Source: rec.pyrotechnics
Comments:
Preparation:

Strontium nitrate.....36
Sodium oxalate.....8
Shellac.....5
Sulfur.....3
Potassium perchlorate.....10

Aluminum torch
Source: rec.pyrotechnics
Comments:
Preparation:

potassium perchlorate.....13
Fine aluminum powder.....6
Flake Aluminum.....5
Dextrin or lycopodium.....1

Red and aluminum torch #1
Source: rec.pyrotechnics
Comments: The composition is a modification of the 'Aluminum torch'. Suggested dimensions for the torch are 2.22 cm diameter and 45 cm length.
Preparation: Before ramming, this formula should be moistened with a solution of 1 part shellac in 16 parts alcohol and 1 part of this solution used to every 36 parts of composition. As this mixture is somewhat difficult to ignite it is necessary to scoop out a little from the top of the torch and replace it with a starting fire composition. Meal powder can be used for that purpose.

Strontium nitrate.....35
Potassium perchlorate.....7
Shellac.....4
Coarse flake Aluminum.....4
Lycopodium.....1

Red and aluminum torch #2
Source: rec.pyrotechnics
Comments: The composition is a modification of the 'Aluminum torch'. Suggested dimensions for the torch are 2.22cm diameter and 45cm length.
Preparation: Before ramming, this formula should be moistened with a solution of 1 part shellac in 16 parts alcohol and 1 part of this solution used to every 36 parts of composition. As this mixture is somewhat difficult to ignite it is necessary to scoop out a little from the top of the torch and replace it with a starting fire composition. Meal powder can be used for that purpose.

Strontium nitrate.....13
Sulfur.....3
Mixed Aluminum.....3

Extra bright torch
Source: rec.pyrotechnics
Comments: According to the original text: "An aluminum torch of heretofore unheard of brilliance and giving an illumination, in the 2.54cm size, of what is said to be 100000 candlepower". Testing with paint grade aluminum revealed that it burns very bright indeed at a steady slow burnrate and with little residue. It is easily pressed in tubes.
Preparation: Rub the Vaseline into the barium nitrate. Mix the sulfur and the aluminum separately. Then mix it with the barium nitrate/vaseline mixture. A starting fire mixture is required for ignition. The 'starting fire #1' composition can be used for that purpose.

Barium nitrate.....38
Mixed Aluminum.....9
Sulfur.....2
Vaseline.....1

Chapter 4: Sparkler compositions

Sparkler #1
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium perchlorate.....40
Mixed titanium fines.....40
Dextrin.....18
Propyl guar.....2

Sparkler #2
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium nitrate.....14
Sulfur.....3
Charcoal.....3
Aluminum.....2
Binder.....qs

Sparkler #3
Source: Chemical abstracts[14] 122, 59596
Comments: Better visual effect, better spark lifting altitude. lower combustion rate, and better safety.
Preparation:

Charcoal.....5-20
Nitroguanidine.....10-20
Ti or Mg/Al alloy powder (as spark forming component).....10-20
Fe-powder (spark forming).....10-30
Potassium nitrate.....balance

Sparkler #4
Source: rec.pyrotechnics, posted by Footleg <chm5pf@sun.leeds.ac.uk
Comments:
Preparation:

Potassium perchlorate.....60
Aluminum.....30
Dextrin.....10

Sparkler #5
Source: rec.pyrotechnics, posted by Footleg <chm5pf@sun.leeds.ac.uk
Comments:
Preparation: Dextrin binder can probably be used.

Potassium nitrate.....14
Sulfur.....3
Charcoal.....3
Aluminum.....2

Sparkler #6
Source: rec.pyrotechnics, posted by Footleg <chm5pf@sun.leeds.ac.uk
Comments:
Preparation:

Barium chlorate.....16
Aluminum flitter.....24
Shellac.....3

Sparkler #7
Source: rec.pyrotechnics, posted by Footleg <chm5pf@sun.leeds.ac.uk
Comments:
Preparation:

Strontium nitrate.....5
Shellac.....1

Sparkler #8
Source: rec.pyrotechnics, posted by Footleg <chm5pf@sun.leeds.ac.uk
Comments:
Preparation:

Potassium perchlorate.....50
Fine Aluminum.....35
Dextrin.....15

Sparkler #9
Source: rec.pyrotechnics, posted by Footleg <chm5pf@sun.leeds.ac.uk
Comments:
Preparation:

Potassium nitrate.....7
Sulfur.....2
Charcoal.....4
Aluminum.....3

Sparkler #10
Source: rec.pyrotechnics. Original by Bruce Snowden, post by Sweden <sweden@synchron.ct.se.
Comments: The composition burns very fast and explosively if one doesn't pay extreme attention towards the diameter of the sparkler. It is found that if the comp is thinner than 1.8 mm then the propagation stops. If the diameter is more than 2.0 mm the burning is too fast, sending sparks all the way down to the ground. Another severe problem is keeping the ingredients mixed in the suspention. The Ti has a very strong tendensy of ending up in the bottom of the test tube, making a plug. Another problem is that after the first dipping and subsequent drying, the second (and last) dipping has to be performed very, very fast or else the first dipping is spoiled, hence the bound dextrin is redisolved. Using coarser perchlorate, finer titanium and making the dipping mixture thicker (by using less solvent) may solve these problems.
Preparation:

potassium perchlorate.....47
Titanium.....47
Dextrin.....6

Sparkler #11
Source: rec.pyrotechnics. Inventor of this composition is Bruce Snowden. posted by Sweden <sweden@synchron.ct.se
Comments:
Preparation: The aluminum is probably supposed to be atomized, but experimentation is required.

Potassium nitrate.....14
Sulfur.....3
Charcoal.....3
Aluminum.....2
Binder.....qs

Sparkler #12
Source: rec.pyrotechnics. Original is by Bruce Snowden. Posted by Sweden <sweden@synchron.ct.se
Comments:
Preparation: Guar gum comes from the seeds of the legume Cyanopsis Psoralioides. It should be possible to substitue red gum.

Potassium perchlorate.....40
Mixed titanium fines.....40
Dextrin.....18
Propyl guar.....2

Sparkler #13
Source: "Mengen en Roeren"[6], page 224.
Comments:
Preparation: Mix the composition with a 10% dextrin solution in water, and dip iron wire or wood in the moist compositon. Adding 500 parts strontium nitrate will produce a red color, adding 60 parts barium nitrate will produce a green color.

Potassium chlorate.....300
Aluminum granules.....60
Charcoal.....2

Sparkler #14
Source: rec.pyrotechnics. Posted by Tom137 <tom137@aol.com.Composition from Weingart[5], p. 190.
Comments:
Preparation:

Potassium perchlorate.....10
Aluminum, finely powdered.....7
Dextrin.....3
Water.....20

Chapter 5: Smoke Compositions

White smoke
Source: "Mengen en Roeren"[6], page 224.
Comments:
Preparation:

Potassium nitrate.....4
Charcoal.....5
Sulfur.....10
Wood dust.....3

Red smoke
Source: "Mengen en Roeren"[6], page 224.
Comments:
Preparation:

Potassium chlorate.....15
para-nitroaniline red.....65
Lactose.....20

Green smoke
Source: "Mengen en Roeren"[6], page 224.
Comments:
Preparation:

Synthetic indigo.....26
Auramine (yellow).....15
Potassium chlorate.....35
Lactose.....26

Smoke composition #1
Source: rec.pyrotechnics
Comments: Different sources mention differnt compositions. The most often mentioned one is given here.
Preparation: The mixture is most succesfull when prepared by melting the sugar and potassium nitrate together on low heat, but this requires good stirring, and there is a risk of accidential ignition. The molten mixture can be poured in cardboard containers and a fuse insterted while the mixture solidifies.

Potassium nitrate.....50
Sugar.....50

Smoke composition #2
Source: rec.pyrotechnics (composition is an U.S. military smoke composition)
Comments: The mixture is difficult to ignite. Hexachloroethane is poisonous, and can be replaced by 72 parts PVC. This, however, makes the mixture yet harder to ignite. The zinc oxide can be replaced by titanium dioxide (2 parts ZnO replaced by 1 part TiO2). The smoke is slightly irritating and not suitable for indoor use.
Preparation:

Zinc oxide.....45
Hexachloroethane.....45

Aluminum.....10

Smoke composition #3
Source: "Spelen met vuur"[9]
Comments:
Preparation:

Zinc powder.....35
CCl4.....41
Zinc oxide.....20
Diatomeous earth.....5

Smoke composition #4
Source: "Spelen met vuur"[9]
Comments:
Preparation:

Zinc powder.....25
CCl4.....50
Zinc oxide.....20
Diatomeous earth.....5

Smoke composition #5
Source: Kirk-Otthmer technical encyclopedia[8], chapter 'Explosives and Propellants'.
Comments: Heat of reaction: 2.579 kJ/g, Gas volume: 62 cm3/g, ignition temperature: 475°C, impact sensitivity test: 15% of TNT
Preparation:

Zinc.....69
Potassium perchlorate.....19
Hexachlorobenzene.....12

Chapter 6: Flash, burst charges and whistle mix

Flash #1
Source: Lancaster[2], listed as ‘Thunder #1’.
Comments: The sulfur can be replaced by antimony trisulfide and the sound of a salute made with this composition will change very little.
Preparation:

potassium perchlorate.....50
Aluminum.....23
sulfur.....27

Flash #2
Source: rec.pyrotechnics, Listed as ‘Ellern #121' in Ellern [4].
Comments:
Preparation:

potassium perchlorate.....70
Aluminum (dark pyro).....30

Flash #3
Source: rec.pyrotechnics
Comments: Larger percentage of aluminum results in a stronger flash. This composition is slightly less sensitive than the usual perchlorate mixtures which also contain sulfur.
Preparation:

Potassium perchlorate.....65...70%
Aluminum powder.....rest (up to 100%)

Flash #4
Source: rec.pyrotechnics. Post by Mark Anthony Messina <messim3@hall103.its.rpi.edu
Comments:
Preparation:

Potassium perchlorate.....3
Aluminum, 400 mesh.....3
Sulfur.....1

Flash #5
Source: rec.pyrotechnics. Post by Bill Nelson <billn@hpcvaac.cv.hp.com. Composition from Allen's book.
Comments: This is a relatively safe flash composition. Burns with a brilliant white light in an open tube, or when unconfined. When well confined, it produces a loud, low pitched report and a short but intense flash.
Preparation:

Potassium nitrate.....50
Sulfur.....30
Aluminum.....20

Flash #6
Source: rec.pyrotechnics. Post by Patrick Arnold <pcats@cryton.demon.co.uk
Comments: Can be ignited by a fairly low temperature flame, and produces a greenish flash when magnesium is used. Burns very fast, and produces a loud report even in an open container.
Preparation:

Magnesium or Aluminum.....1
Barium sulfate.....1

Flash #7
Source: rec.pyrotechnics. Post by Barrie Hiern <ilikecpu@nevada.edu
Comments: Relatively insensitive.
Preparation:

Barium nitrate.....4
Alumium (fine mesh).....2
sulfur.....1

Flash #8
Source: PML mailing list, post by Bill Ofca <ofca@mhv.net
Comments:
Preparation: Dampen the mix lightly with water and mix thoroughly such that the material is crumbly but then packs tightly into a ball. If it is at all greasy feeling or mushy, there is way too much water. Save some dry mix on the side just in case it becomes too wet during the dampening. Granulate the damp comp by rubbing the packed ball over a 20 mesh screen. Do not use any screens larger than 20 mesh. If the screen plugs, the comp is too damp. Add more dry comp and thoughly mix in. After drying the granulated powder, it can be used in flash bags. About 3 to 5 grams works well in a 3 inch shell. Experimentation is needed to adjust the amount of burst for good results with different stars and shell construction. This powder can also be used ungranulated, in a central flash bag, in larger shells.

Potassium nitrate.....3
Potassium perchlorate.....3
Dark aluminum (USB 809).....3
Barium nitrate.....1
Antimony sulfide (CN).....1
Sulfur.....1
Dextrin.....1/2

Flash #9
Source: rec.pyrotechnics. Post by Wouter Visser <wfvisser@stud.chem.ruu.nl
Comments: The use of permanganate in pyrotechnic compositions is not recommended, since it is unstable and will decompose over time. Also, like all flash mixtures, this mixture is quite sensitive and powerfull. Great care should be taken when handling this mixture.
Preparation:

Potassium permanganate.....12
Aluminum.....7
Sulfur.....10

Flash #10
Source: Shimizu[1], Page 44
Comments: Listed as a report formulation.
Preparation:

Potassium perchlorate.....80
Aluminum.....27
Sulfur.....3

Flash #11
Source: Shimizu[1], Page 44
Comments: Listed as a report formulation. Shimizu states that this composition produces the loudest report obtainable with a pottasium perchlorate/ aluminum/sulfur composition.
Preparation:

Potassium perchlorate.....64
Aluminum.....23
Sulfur.....13

Flash #12
Source: Shimizu[1]. Page 44
Comments: Listed as a report formulation. This composition produces slightly less noise than "Flash #11", but is safer to handle than similar compositions containing sulfur.
Preparation:

Potassium perchlorate.....72
Aluminum.....28

Flash #13
Source: Lancaster[2], page 120
Comments: Listed as a report formulation
Preparation:

Barium nitrate.....68
aluminum, dark pyro.....23

Sulfur.....9

H3 Bursting charge
Source: Shimizu[1]. Page 207
Comments: This energetic burst charge is used for small diameter shells (2...3 inch), since it makes a large and symmetrical burst possible. Besides the composition below, a ratio of chlorate to hemp coal of 10:3 is also popular. The sensitivity of this mixture to shock and friction is unexpectedly low, as long as the composition does not come into contact with sulfur or sulfur compounds.
Preparation:

Potassium chlorate.....75
Hemp coal (or Paulownia coal).....25
Glutinous rice starch.....+2%

Potassium perchlorate bursting charge #1
Source: Shimizu[1]. Page 208. Listed as 'KP burst charge'
Comments: This energetic burst charge can be used for small shells, but is unsuitable for the smallest diameters (2...3 inch). It is much safer to handle than the H3 bursting charge since it contains no chlorates.
Preparation:

Potassium perchlorate.....70
Hemp coal (or Paulownia coal).....18
Sulfur.....12
Glutinous rice starch.....+2%

Potassium perchlorate bursting charge #2
Source: Shimizu[1]. Page 210
Comments: Shimizu lists this composition as 'burst charge No. 5'. This compositions sensitivity is quite low, although higher than that of black powder. The explosive force of this composition is lower than that of the 'Potassium perchlorate bursting charge #1'. This burst charge is often used in shells of middle and large diameter (6...10 inch).
Preparation:

Potassium perchlorate.....70
Hemp coal (or Paulownia coal).....30
Glutinous rice starch.....+2%

Potassium perchlorate bursting charge #3
Source: Shimizu[1]. Page 210
Comments: Shimizu lists this composition as 'burst charge No. 44'. The potassium bichromate catalyses the decomposition of the potassium perchlorate. This composition's sensitivity is quite low, although higher than that of black powder. The explosive force of this composition is lower than that of the 'Potassium perchlorate bursting charge #1'. This burst charge is often used in shells of middle and large diameter (6...10 inch).
Preparation:

Potassium perchlorate.....70
Hemp coal (or Paulownia coal).....30
Potassium bichromate.....5
Glutinous rice starch.....+2%

Potassium perchlorate bursting charge #4
Source: Shimizu[1]. Page 210
Comments: Shimizu lists this composition as 'burst charge No. 46'. The potassium bichromate catalyses the decomposition of the potassium perchlorate. This composition's sensitivity is quite low, although higher than that of black powder. The explosive force of this composition is higher than that of the 'Potassium perchlorate bursting charge #1', especially when the particle size of the carbon is small.
Preparation:

Potassium perchlorate.....70
Hemp coal (or Paulownia coal).....30
Lampblack.....25
Potassium bichromate.....+5%
Glutinous rice starch.....+2%

Smokeless flash powder
Source: "Mengen en Roeren"[6], page 224
Comments:
Preparation:

Zirconium.....28
Zirconium hydride.....7
Magnesium.....7
Barium nitrate.....30
Barium oxyde.....25
Rice starch.....5

Photoflash
Source: Kirk-Otthmer chemical encyclopedia[8]. Chapter 'Explosives and Propellants'.
Comments: Heat of reaction: 8.989 kJ/g, Gas volume: 15 cm3/g, ignition temperature: 700°C, impact sensitivity test: 26% of TNT. half a pound of this flash delivers 120 million candlepowder. It is used in the M120A1 and M112A1 flare cartdriges.
Preparation:

Aluminum (20 micron; atomized).....40
Potassium perchlorate (24 micron).....30
Barium nitrate (150 micron).....30

Purple Flash
Source: rec.pyrotechnics
Comments:
Preparation:

Magnesium.....10
Potassium perchlorate.....10
Cupric oxide.....3
Strontium nitrate.....3
PVC.....1

Yellow flash
Source: "Spelen met vuur"[9]
Comments:
Preparation:

Magnesium.....1
Sodium nitrate.....6

Green flash
Source: rec.pyrotechnics
Comments:
Preparation:

potassium perchlorate.....6
barium nitrate.....3
Aluminum powder.....5

Whistle mix #1
Source: rec.pyrotechnics. Composition from Ellern[4].
Comments:
Preparation:

Potassium perchlorate.....72.5
Sodium salicylate.....27.5

Whistle mix #2
Source: rec.pyrotechnics. Composition from Ellern[4].
Comments:
Preparation:

Potassium nitrate.....30
Potassium dinotrophenate.....70

Whistle mix #3
Source: rec.pyrotechnics. Composition from Ellern[4] and Shimizu[1].
Comments:
Preparation:

Potassium perchlorate.....70
Sodium benzoate.....30

Whistle mix #4
Source: rec.pyrotechnics. Composition from Oztap
Comments:
Preparation:

Potassium chlorate.....40
Sodium chlorate.....10
Potassium nitrate.....30
Sodium salicylate.....10
Paraffin oil.....10
Ferric oxide.....+0.2

Whistle mix #5
Source: rec.pyrotechnics. Composition from Lancaster[2].
Comments: This mixture is quite sensitive to friction and shock.
Preparation:

Potassium chlorate.....75
Gallic acid.....25

Chapter 7: Miscellaneous compositions

Black powder
Source: Various sources
Comments: Two methods of preparation exist, the precipitation or CIA method, and the ball milling method. The latter produces slightly superior

results. Special attention should be given to the charcoal used. Charcoal is best obtained by pyrolysis of soft-wood. Preffered types of wood are willow, grapevine and laurel. In general all young, thin soft-woods without hard knots can be used. Although several different compositions are used for several purposes, the composition given here is used most often:
Preparation: Merely mixing the charcoal, sulfur and potassium nitrate by hand does not make black powder. They must really be incorporated into each other. This can be done by ball milling or by the salting out ('CIA') method. A detailed description of the process can be found in many books.

Potassium nitrate.....75
Charcoal.....15
Sulfur.....10

Yellow powder
Source: rec.pyrotechnics, post by The Silent Observer <silent1@ix.netcom.com. It comes from a text of 'Samuel Guthrie' written in 1831. More about this mixture can be found in Davis[10], page 30 and 31.
Comments: It is sometimes called "Fulminating powder". The mixture burns three times quicker than common black powder.
Preparation: The compounds are sometimes molten together, which appears to be a very dangerous operation.

Potassium nitrate.....3
Potassium carbonate.....2
Sulfur.....1

Priming composition #1
Source: rec.pyrotechnics
Comments:
Preparation:

Barium nitrate.....4
Potassium nitrate.....3
Sulfur.....1
Shellac.....1

Priming composition #2
Source: "Spelen met vuur"[9]
Comments:
Preparation:

Potassium permanganate.....54
Powdered iron.....47

Priming composition #3
Source:
Comments: Suitable for priming most stars. Chlorate stars or stars containing ammonium compounds should never be primed with this composition. It can be stored in small plastic containers.
Preparation:

Potassium nitrate, fine, sieved.....75
Sulfur, fine (preferably flour).....10
Charcoal, fine, sieved.....15

Priming composition #4
Source:
Comments: Suitable for priming stars. Aluminum and manganese dioxide aid in ignition, but are not necessary.
Preparation:

Potassium perchlorate.....80

Charcoal, fine.....15
Red gum.....4
Manganese dioxide (optional) 9
Aluminum, (fine flake or pyro grade; optional)....4
Dextrin.....2

Priming composition #5
Source:
Comments: This type of prime helps reduce the friction and impact sensitivity of chlorate stars which is especially important when shells fire from the mortar and experience set-back or "kick" from lift acceleration.
Preparation:

Potassium perchlorate.....68
Charcoal, air float.....20
Silicon or Aluminum.....9
Dextrin.....3

Priming composition #6
Source: PML, post by J. Humby <jhumby@iee.org
Comments: This prime is safe to use with chlorate stars and gives a much better color than a black powder prime. The difference is most noticable on red stars which tend to a dark salmon color when primed with black powder.
Preparation: Dissolve the potassium nitrate in hot water and mix with the charcoal.

Potassium chlorate.....52
Potassium nitrate.....8
Charcoal.....30
Lampblack.....10
Binder.....+5%

Priming composition #7
Source: Shimizu[1], page 218
Comments: A standard black powder priming cannot be used with stars that contain ammonium perchlorate, since a double decomposition reaction forms the highly hygroscopic ammonium nitrate. This makes the stars unignitable. Replacing the potassium nitrate prime by this priming composition solves that problem.
Preparation:

Sodium nitrate.....80
Paulownia coal.....15
Sulfur.....5

Priming composition #8
Source: Shimizu[1], page 225. Listed as "Ignition composition for twinklers".
Comments: Used for strobe stars of ammonium perchlorate base to prevent nitrates from the outer priming to react with the ammonium perchlorate. The layer should be at least 1-2mm thick.
Preparation:

Potassium perchlorate.....74
Rosin (BL combustion agent) or Red gum.....12
Hemp coal (or paulownia coal).....6
Aluminum (fine flake).....3
Potassium bichromate.....5

Delay composition #1
Source: Kirk-Otthmer technical encyclopedia[8], chapter 'Explosives and Propellants'.
Comments: Heat of reaction: 2.010 kJ/g; Gas volume: 13 cm3/g; Ignition temperature: 450°C; impact sensitivity test: 12 % of TNT.

Preparation:

Barium chromate.....90
Boron.....10

Delay composition #2
Source: Kirk-Otthmer technical encyclopedia[8], chapter 'Explosives and Propellants'.
Comments: Heat of reaction: 2.081 kJ/g; Gas volume: 12 cm3/g; Ignition temperature: 485°C; impact sensitivity test: 23 % of TNT.
Preparation:

Barium chromate.....60
Zirconium-nickel alloy.....26
Potassium perchlorate.....14

Changing Relay #1
Source: Shimizu[1], page 187
Comments: This type of composition is put between two color layers in a star to create the illusion that all the stars change their color clearly and simultaneously in spite of slight deviations in manufacture.
Preparation:

Potassium perchlorate.....35
Potassium nitrate.....35
Hemp coal (or Paulownia coal).....24
Soluble glutinous rice starch.....6

Changing Relay #2
Source: Shimizu[1], page 187
Comments: This type of composition is put between two color layers in a star to create the illusion that all the stars change their color clearly and simultaneously in spite of slight deviations in manufacture.
Preparation:

Potassium perchlorate.....81
Red gum.....13
Soluble glutinous rice starch.....6

Golden rain #1
Source: "Mengen en Roeren"[6], page 224
Comments: Burns with a yellow color, and emits yellow sparks that are formed by the slowly burning lampblack.
Preparation:

Potassium nitrate.....18
Sulfur.....8
Lampblack.....5

Golden rain #2
Source: "Mengen en Roeren"[6], page 224
Comments: Burns with a yellow color, and emits yellow sparks that are formed by the slowly burning lampblack and the iron filings.
Preparation:

Potassium nitrate.....10
Sulfur.....2
Lampblack.....2
Fine iron filings.....7

Fire dust
Source: Shimizu[1], page 67
Comments: The composition spreads a large amount of long lived orange fire dust particles. The lifetime of those particles depends mainly on the consistency and type of charcoal.
Preparation: The components must be intimately mixed. This can be done by dissolving the potassium nitrate in a minimum amount of boiling water, adding the charcoal and sulfur and precipitating the potassium nitrate in the form of fine particles by adding a large amount of isopropyl alcohol and cooling the solution as fast as possible to 0°C, followed by filtering and drying.

Potassium nitrate.....58
Charcoal.....35
Sulfur.....7

Senko Hanabi (Japanese sparklers), sulfur based
Source: Shimizu[1], page 70
Comments: For more details on what the effect looks like and how devices can be constructed, look at §10.4, "The phenomenon of Senko-Hanabi" in Shimizu's book (on page 68). Realgar may be used instead of sulfur, see 'Senko Hanabi (Japanese sparklers), realgar based' for a realgar based formula. The realgar based formula produces larger en more beautiful sparks.
Preparation:

Potassium nitrate.....60
Charcoal or soot.....10-20
Sulfur.....20-30

Senko Hanabi (Japanese sparklers), realgar based
Source: Shimizu[1], page 70
Comments: For more details on what the effect looks like and how devices can be constructed, look at §10.4, "The phenomenon of Senko-Hanabi" in Shimizu's book (on page 68). Sulfur may be used instead of realgar, see 'Senko Hanabi (Japanese sparklers), sulfur based' for a sulfur based formula. This realgar based formula produces larger en more beautiful sparks than the sulfur based formula.
Preparation:

Potassium nitrate.....35
Charcoal or soot.....20
Realgar.....45

"Pharaoh Snakes"
Source: "Mengen en Roeren"[6], page 223
Comments: When lighted, this composition produces very voluminous snake-shaped ash. Mercury compounds are very poisonous, and extreme caution should be excercised during preparing and handling this composition. Wear gloves at all times, and use a fume hood.
Preparation: Instructions for making mercuric thiocyanate: 1) Dissolve 64 parts of mercuric nitrate in water, and separately dissolve 36 parts potassium thiocyanate in water. 2) Mix both solutions, and filtrate to collect the precipitate that forms upon mixing. 3) Rinse the collected precipitate 3 times with distilled water, and place it in a warm (not hot) place to dry.

Mercuric thiocyanate.....100
Dragant.....5
arabic gum binder.....qs

Thermite
Source:
Comments: This composition produces an enormous amount of heat (83.7 kJ per mol of iron oxide that has reacted), molten iron and aluminum oxide. Other metal oxides can be substituted to make other thermite-like compositions that behave differently. Some may explode (like CuO with aluminum or PbO2 with aluminum), so caution is required when experimenting with different mixtures.
Preparation:

Red iron oxide, Fe2O3.....3
Aluminum.....1

Red thermit
Source: Shimizu[1], page 29
Comments: This mixture is sometimes used for priming.
Preparation:

Pb3O4.....80
Ferro-silicon.....20

Electric Match
Source: PML, post by Mike Carter <pyro@primenet.com
Comments: This composition does not require the use of a bridge wire. The composition itself acts as a resistor. Comments from the poster: "The matches fire just fine on 200 feet of #16 guage wire and a standard 12V battery two at a time. Sometimes there's a delay...I haven't tested these on the high power electric firing systems so I don't know how they fare."
Preparation: 1) Bind in water. Make CMC & Water into a mostly soupy mess. Add components into a container and mix well. 2) Dip freshly stripped wire with both conductors about 1mm or slightly less between them, evenly parallel. The longer the exposed metal on the wire, the less Ohmage the match will have. Allow to dry in vertical hanging position. Redip as necessary. I find that two dips is just fine. 3) Once the comp is dry, you will need to coat it with NC (Nitrocellulose) laquer. I find that two dips in the NC laquer is enough to keep the very brittle comp from cracking or splitting while manuevering the wire into your shell or mine or rocket motor. I normally will color the double-dippers with some Iron Oxide stirred into the NC Laquer so I have a visual that they're unsuitable for firing whistle motors. (Double Dipped tend to go BANG, and destroy the motor).

Potassium chlorate, Ball milled into a fine powder.....16
Conductive lampblack.....3
Magnalium (50/50), 200 mesh.....3
Atomized aluminum, 120 mesh.....2
Zirconium, 200 mesh (optional).....2
CMC Binder (carboxymethylcellulose).....5

Veline's priming
Source: rec. pyrotechnics, post by Lloyd E. Sponenburgh <lloyds@fiscalinfo.com. This set of compositions was invented by Robert Veline and is used in Kosankie's 'Chemistry of Fireworks (Chemistry of color) class'.
Comments: These compositions are part of a matched set invented by Robert Veline. The compositions mix compatibly to produce a wide range of other colors. Examples are given below. The wood meal in this prime makes the stars a little 'fuzzy', making the stars much more easy to ignite. Without the wood meal prime the stars are often blown blind.
Preparation: Summary of Robert Veline's own comments: "Potassium perchlorate is a fine powder. Parlon is Hercules brand or Superchlon brand from Ishihara co. ltd. Red gum is a fine powder. Copper(II)oxide may be substituted by copper carbonate without much change in performance. Calcium carbonate is 200 mesh, 'Whiting'. More pure forms slow the burn rate and degrade the color."

Potassium perchlorate.....55
Charcoal, air float.....20
Wood meal, 70 mesh.....6
Red Iron Oxide, Fe2O3.....5
Magnalium (50/50).....5
Potassium dichromate.....5
Dextrin.....4

Brilliant core coating composition
Source: Composition from Shimizu[1], page 219.
Comments: This composition can be used to prime the 'Brilliant Core' stars (see effect stars). roll the cores in this prime untill they are round.
Preparation:

Potassium perchlorate.....33
Barium nitrate.....34
Aluminum (fine flake).....10
Rosin (BL combustion agent).....8

Antimony trisulfude (or sulfur).....9
Boric acid.....1
Soluble glutinous rice starch.....5

Chapter 8: colored stars

Red star #1
Source: rec.pyrotechnics archive. Composition from Shimizu[1], page 215
Comments: The perchlorate can be substituted by chlorate without changing the color.
Preparation:

Potassium perchlorate.....66
Red gum.....13
Lampblack.....2
Strontium carbonate.....12
Polyvinyl chloride.....2
Soluble Glutinous Rice Starch.....5

Red star #2
Source:
Comments:
Preparation: Dissolve shellac in boiling ethanol, add the other ingredients and proceed as usual. The stars take unexpectedly long to dry. They can be dried in the sun or in a vacuum. Smaller stars dry faster.

Potassium chlorate.....20
Strontium nitrate.....60
Shellac.....20

Red star #3
Source:
Comments:
Preparation: Dissolve shellac in boiling ethanol, and add the other ingredients.

Potassium chlorate.....65
Strontium carbonate.....15
Shellac.....20

Red star #4
Source:
Comments:
Preparation: Dissolve shellac in boiling ethanol, and add the other ingredients.

Potassium perchlorate.....44
Strontium nitrate.....31
Red gum.....15
Shellac (binder).....5
PVC or saran .....8 or 7

Red star #5
Source:
Comments:

Preparation: Add water. For priming "priming composition #7" from the chapter with miscellaneous compositions can be used.

Ammonium perchlorate.....30
Potassium perchlorate.....35
Strontium carbonate.....18
Hexamine.....2
Charcoal, fine.....2
Red gum.....16
Dextrin.....4

Red star #6
Source: "The pyroguide" (a document found on internet)
Comments: Dangerous mixture, since it contains both sulfur and a chlorate.
Preparation: Bind with shellac dissolved in ethanol.

Potassium chlorate.....9
Sulfur.....2
Lampblack.....1
Strontium nitrate.....9

Red star #7
Source: post on rec.pyrotechnics by Tommy Hakomaki <tommy.hakomaki@mailbox.swipnet.se. Composition from an old swedish book.
Comments:
Preparation:

Potassium nitrate.....36
Sulfur.....30
Meal powder.....36
Strontium nitrate.....40
Antimony sulfide.....5
Charcoal.....12

Red star #8
Source: rec.pyrotechnics. Post by Andrew Krywonizka. Composition from Lancaster[2].
Comments: Produce as a cut star
Preparation:

Potassium perchlorate.....70
Strontium carbonate.....15
Red gum.....9
Charcoal 150 Mesh.....2
Dextrin.....4

Red star #9
Source: rec.pyrotechnics. Post by Andrew Krywonizka. Composition from Lancaster[2].
Comments: Produce as a pressed star
Preparation:

Strontium nitrate.....55
Magnesium.....28
PVC.....17

Red star #10
Source: PML, post by David Abate <daveab@ix.netcom.com.
Comments: Crackling stars can be made with this composition. The poster used large pistol primers (idea from Best of AFN II), coated with 70%

KClO4/30% Dark aluminum for cores, and rolled these into stars with the star mixture. The stars were hard to ignite and needed priming.
Preparation:

Potassium perchlorate.....68
Strontium carbonate.....13
Red gum.....14
Dextrin.....5

Red star #11
Source: rec.pyrotechnics archive. Composition from Shimizu[1], page 217. It's listed under the name "Red star brilliant".
Comments:
Preparation: The magnesium must be coated with linseed oil. Use an acetone or alcohol solvable binder.

Potassium perchlorate.....30
Strontium nitrate (anhydride).....20
Magnesium, 60 mesh.....30
PVC.....18
Lampblack or Paulownia coal.....2

Red star #12
Source: rec.pyrotechnics archive. Composition from Shimizu[1], page 219. It's listed under the name "Ammon red star brilliant".
Comments:
Preparation:

Ammonium perchlorate.....41
Magnesium, 60 mesh.....33.3
Red gum.....9.5
Strontium carbonate.....9.5
Potassium bichromate.....1.9
Soluble glutinous rice starch.....4.8

Green star #1
Source: Composition from Shimizu[1], page 215
Comments:
Preparation:

Barium nitrate.....28.3
Potassium Perchlorate.....47.2
Parlon.....4.7
Red Gum.....14.2
Soluble Glutinous Rice Starch.....5.6

Green star #2
Source:
Comments: A simple but nice (somewhat yellowish) green.
Preparation: Dissolve shellac in boiling ethanol.

barium nitrate.....7
potassium chlorate.....7
shellac.....2

Green star #3
Source:
Comments: The composition leaves lots of ash. Ammonium perchlorate improves it (- Green star #4).
Preparation: Mix Parlon with magnesium. Add 50 volume parts of acetone, mix well and mix in the other ingredients. If PVC is used, add the

correct amount of the solution in THF to the other ingredients.

barium nitrate.....50
lab grade magnesium powder.....32
Parlon or PVC.....18

Green star #4
Source:
Comments:
Preparation: Mix Parlon with magnesium. Add 60 volume parts of acetone for Parlon, mix well and mix in the other ingredients. If PVC is used, add the correct amount of the solution in THF to the other ingredients.

barium nitrate.....56
lab grade magnesium powder.....32
Parlon or PVC 17
ammonium perchlorate.....25

Green star #5
Source:
Comments: This mixture can be improved using ammonium perchlorate (Green star #6).
Preparation: Add acetone. Prime with black powder. Aluminum should be very fine, preferably dark pyro grade.

Barium nitrate.....65
Aluminum (very fine).....10
Parlon rubber.....20
Sulfur.....4
Boric acid.....2

Green star #6
Source:
Comments: Fierce burning.
Preparation: Add acetone. Prime with "Priming composition #7".

Barium nitrate.....65
Saran.....20
Red gum.....3
Sulfur.....7
Aluminum (very fine).....10
Ammonium perchlorate.....15
Boric acid.....2
Dextrin.....2

Green star #7
Source: PML, post by Charley Wilson <cwilson@celsvr.stortek.com.
Comments: Beautiful green. Direct substitution of barium nitrate with strontium nitrate produces a nice red.
Preparation: Dissolve shellac in boiling ethanol. Prime with potassium perchlorate based strobe prime

ammonium perchlorate.....50
barium nitrate.....35
shellac.....15

Green star #8
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with alcohol.

Barium chlorate.....8
Lampblack.....1
Shellac powder.....1

Green star #9
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with alcohol.

Barium nitrate.....3
Potassium chlorate.....4
Shellac powder.....1
Dextrin.....1/4

Green star #10
Source: post on rec.pyrotechnics by Tommy Hakomaki <tommy.hakomaki@mailbox.swipnet.se. Composition from an old swedish book.
Comments:
Preparation:

Potassium nitrate.....35
Sulfur.....10
Mealpowder.....40
Barium nitrate.....50
Charcoal.....10

Green star #11
Source: rec.pyrotechnics, post by Bill Nelson <billn@peak.org, Composition from Davis[10].
Comments: This formulation is based on one given by Clark, who's work is suspect.
Preparation:

Potassium perchlorate.....6
Barium perchlorate.....12
Aluminum.....8
Dextrin.....2
Shellac.....1

Green star #12
Source: rec.pyrotechnics,post by Bill Nelson <billn@peak.org, Composition from "Pyrotechnica VII"[3] by JW Stone.
Comments:
Preparation:

Potassium perchlorate.....48
Barium nitrate.....32
Red Gum.....14
Charcoal.....2
Parlon.....12
Dextrin.....6
Sulfur.....5

Green star #13
Source: rec.pyrotechnics,post by Bill Nelson <billn@peak.org, Composition from "Pyrotechnica VII"[3] by JW Stone.
Comments:
Preparation:

Potassium perchlorate.....28
Barium nitrate.....16
Red Gum.....4
Charcoal.....1
Parlon.....10
Dextrin.....3
Aluminum #809.....5

Green star #14
Source: rec.pyrotechnics,post by Bill Nelson <billn@peak.org, Composition from "Pyrotechnica VII"[3] by T. Fish.
Comments:
Preparation:

Barium nitrate.....65
Parlon.....20
Pyro Aluminum.....10
Red gum or sulfur.....5
Boric acid.....+2

Green star #15
Source: PML, post by Bill Ofca <ofca@csbh.mhv.net
Comments: Original name: 'Emerald green'. The mix is not very sensitive although chlorates are present.
Preparation: Dampen with 75/25 water/alcohol and cut or roll into 10mm stars. The red gum can be replaced with shellac. If shellac is used, dampen with 50/50 water alcohol.

Potassium perchlorate.....22
Barium chlorate.....43
Barium nitrate.....9
Red gum.....22
Dextrin.....4

Green star #16
Source: rec.pyrotechnics archive. Composition from Shimizu[1], page 218. It’s listed under the name "Green star brilliant".
Comments:
Preparation: The magnesium must be coated with linseed oil. Use an acetone or alcohol solvable binder.

Potassium perchlorate.....16
Barium nitrate.....42
Magnesium, 60 mesh.....25
PVC.....15
Lampblack or Paulownia coal.....2

Green star #17
Source: rec.pyrotechnics archive. Composition from Shimizu[1], page 219. It’s listed under the name "Ammon green star brilliant".
Comments:
Preparation: The magnesium must be coated with potassium dichromate.

Ammonium perchlorate.....41
Magnesium, 60 mesh.....33.3
Red gum.....9.5
Barium carbonate.....9.5
Potassium bichromate.....1.9
Soluble glutinous rice starch.....4.8

Blue star #1

Source: rec.pyrotechnics archive, post by LNiksch <lniksch@aol.com Composition from Shimizu[1], page 216. Listed under the name "blue star II"
Comments: LNiksch :"These stars burn much faster and more blue than any mix containing copper carbonate I have tried"
Preparation: Dampen with alcohol/water 70/30 to make cut or pumped stars.

Potassium perchlorate.....66.5
Red gum.....9.9
Cupric oxide.....13.4
Parlon.....5.4
Soluble Glutinous Rice Starch or Dextrin .....5.6 or 4.8

Blue star #2
Source:
Comments:
Preparation: Add 25 volume parts of water to dextrin and mix in the other ingredients. Use more water if necessary.

Ammonium perchlorate.....60
Sulfur.....17
Copper(II)oxide.....20
Dextrin (binder).....3
Red gum or Shellac.....6

Blue star #3
Source:
Comments:
Preparation: Mix red gum or shellac powder with Parlon. Add 50 volume parts of acetone, mix well and mix in the other ingredients.

potassium perchlorate.....63
copper(II)oxide.....13
Red gum or Shellac (powdered).....10
Parlon or PVC.....14

Blue star #4
Source:
Comments:
Preparation:

potassium perchlorate.....65
cuprous chloride (CuCl).....16
sulfur.....10
Red gum.....7
Parlon or PVC.....11 or 12

Blue star #5
Source:
Comments:
Preparation: Add the PVC solution to the other ingredients. Allow some THF to evaporate, form a cake 1 cm thick and allow it to dry on a plastic plate (check that it doesn't dissolve in THF!). Remove the dry cake and cut it into stars with a pair of scissors.

Ammonium perchlorate.....63
Copper(II)oxide.....13
Sulfur.....10
Dextrin.....10
PVC.....12

Blue star #6
Source: "The Pyroguide" (a document found on internet)
Comments: Dangerous mixture since it contains both sulfur and a chlorate.
Preparation: Bind with dextrin in water.

Potassium chlorate.....9
Copper Acetonarsenite.....2
Mercurous chloride.....1
Sulfur.....2

Blue star #7
Source: "The Pyroguide" (a document found on internet)
Comments: This one is inferior to "Blue star 6". Dangerous mixture since it contains both sulfur and a chlorate.
Preparation: Bind with dextrin in water.

Potassium chlorate.....12
Copper sulfate.....6
Lead chloride.....1
Sulfur.....4

Blue star #8
Source: rec.pyrotechnics. Posted by Tommy Hakomaki <tommy.hakomaki@mailbox.swipnet.se
Comments:
Preparation:

Potassium nitrate.....40
Sulfur.....12
Mealpowder.....40
Copper-ammonium nitrate.....30
Charcoal.....10
Rosin.....5

Blue star #9
Source: Composition from Shimizu[1], page 216. Listed under the name 'blue star I'
Comments:
Preparation:

Potassium perchlorate.....60.8
Red Gum.....9.0
Basic copper carbonate.....12.3
Parlon.....13.1
Soluble glutinous rice starch.....4.8

Blue star #10
Source: PML, posted by David Abate <daveab@ix.netcom.com.
Comments: Crackling stars can be made with this composition. The poster used large pistol primers (idea from Best of AFN II), coated with 70% KClO4/30% Dark aluminum for cores, and rolled these into stars with the star mixture. The stars were hard to ignite and needed priming. The color is a bit pale blue.
Preparation:

Potassium perchlorate.....61
Copper carbonate.....12
Parlon.....13
Red gum.....9
Dextrin.....5

Blue star #11
Source: "Pyrotechnica #6"[3]
Comments: This composition seems just a slight modification of "Blue star #1".
Preparation:

Potassium perchlorate.....67.3
Red gum.....10.0
Copper oxide.....13.6
Parlon.....9.1
Rice starch.....4.5

Blue star #12
Source: PML, posted by Charley Wilson <cwilson@celsvr.stortek.com
Comments:
Preparation:

Ammonium perchlorate.....70
Copper(II)oxide.....15
Shellac.....15

Blue star #13
Source: Greg Gallacci <psygreg@u.washington.edu
Comments: Makes a bright, robins-egg blue star, with a bushy flame.
Preparation:

Potassium perchlorate.....70
Silicone.....10
Copper(II)oxide.....10
PVC.....15

Blue star #14
Source: rec.pyrotechnics. Post by Erik D. Suni <esuni@lk-hp-26.hut.fi. Composition is a slightly modified version from a composition from "The best of AFN II"[14].
Comments:
Preparation: Moisten with water, and cut into 6 mm stars. Do not prime with meal powder. Use a potassium perchlorate based prime instead.

Potassium chlorate.....65
Copper oxychloride.....12.5
Lactose.....12.5
Dextrin.....5
Saran.....5

Blue star #15
Source: rec.pyrotechnics, post by Greg A. Gallacci <psygreg@u.washington.edu
Comments: Fimo is a PVC based modelling clay. The stars are brilliant blue ("Cop-lites blue"), with edges of flame tinted salmon. The stars need priming.
Preparation: Warm the Fimo slightly, to make it more mixable and mix it with the ammonium perchlorate without using solvents. Then mix in the malachite. Screen it several times and make pressed stars.

Ammonium perchlorate.....70
Fimo.....20
Malachite, powdered.....10

Blue star #16

Source: rec.pyrotechnics
Comments:
Preparation:

Potassium Perchlorate.....60
Copper Carbonate.....20
PVC.....15
Dextrin.....5

Purple star #1
Source: "The Pyroguide" (a document found on internet)
Comments: Dangerous mixture since it contains both sulfur and a chlorate.
Preparation: Bind with dextrin in water. The ingredients must be very pure.

Potassium chlorate.....36
Strontium sulfate.....10
Copper sulfate.....5
Lead chloride.....2
Charcoal.....2
Sulfur.....12

Purple star #2
Source: "The Pyroguide" (a document found on internet)
Comments: Dangerous mixture since it contains both sulfur and a chlorate.
Preparation: Bind with dextrin in water. The ingredients must be very pure.

Potassium chlorate.....38
Strontium carbonate.....18
Copper chloride.....4
Lead chloride.....2
Sulfur.....14

Purple star #3
Source: Composition from Shimizu[1], page 216. Listed under the name "Violet star I".
Comments:
Preparation:

Potassium perchlorate.....61.3
Red gum.....9.1
Basic copper carbonate.....5.0
Strontium carbonate.....7.4
Parlon.....12.4
Soluble glutinous rice starch.....4.8

Purple star #4
Source: Composition from Shimizu[1], page 216. Listed under the name "Violet star II" .
Comments:
Preparation:

Potassium perchlorate.....64.0
Red gum.....9.5
Copper(II)oxide.....5.2
Strontium carbonate.....7.8
Parlon.....8.7
Soluble glutinous rice starch.....4.8

Yellow star #1
Source:
Comments:
Preparation: Mix dextrin with 4 volume parts of water and mix in the other ingredients.

Potassium chlorate.....6
Sodium hydrogen carbonate.....2
Dextrin.....2

Yellow star #2
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with shellac in ethanol or dextrin in water.

Potassium chlorate.....8
Sodium oxalate.....3
Lampblack.....2

Yellow star #3
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with alcohol.

Potassium chlorate.....8
Sodium oxalate.....4
Shellac powder.....2
Dextrin.....1

Yellow star #4
Source: rec.pyrotechnics, posted by Tommy Hakomaki <tommy.hakomaki@mailbox.swipnet.se.
Comments:
Preparation:

Potassium nitrate.....48
Sulfur.....24
Mealpowder.....60
Charcoal.....10
Rosin.....2

Yellow star #5
Source: Composition from Shimizu[1], page 215.
Comments:
Preparation:

Potassium perchlorate.....68
Red gum.....18
Lampblack.....2
Sodium nitrate.....7
Soluble glutinous rice starch.....5

Yellow star #6
Source: rec.pyrotechnics archive. Composition from Shimizu[1], page 217. It’s listed under the name "Yellow star brilliant".
Comments:
Preparation: The magnesium must be coated with linseed oil. Use an acetone or alcohol solvable binder.

Potassium perchlorate.....45
Ultramarine.....13
Magnesium, 60 mesh.....30
PVC.....10
Lampblack or Paulownia coal.....2

Yellow star #7
Source: rec.pyrotechnics archive. Composition from Shimizu[1], page 219. It's listed under the name "Ammon yellow star brilliant".
Comments:
Preparation: The magnesium must be coated with potassium dichromate.

Ammonium perchlorate.....41
Magnesium, 60 mesh.....33.3
Red gum.....9.5
Ultramarine.....9.5
Potassium bichromate.....1.9
Soluble glutinous rice starch.....4.8

Orange star #1
Source: "The Pyroguide" (a document found on internet)
Comments: Dangerous mixture since it contains both sulfur and a chlorate.
Preparation: Bind with alcohol.

Strontium nitrate.....36
Sodium oxalate.....8
Potassium chlorate.....5
Shellac powder.....5
Sulfur.....3

Orange/Red star
Source: rec.pyrotechnics archive. Posted by Greg Deputy <gdep@gemstar.gemstar.com
Comments: Sculpy is a PVC based modelling clay - "FIMO" will also work, but is more difficult to mix.
Preparation:

Strontium nitrate.....35
Potassium perchlorate.....40
"Sculpy".....22
Fe2O3.....2

Salmon color star
Source: rec.pyrotechnics, post by Greg A. Gallacci <psygreg@u.washington.edu
Comments: Sculpy is a PVC based modelling clay. The result is a salmon-berry (reddish-orange) color.
Preparation: Warm the sculpy slightly, to make it more mixable and mix it with the ammonium perchlorate without using solvents. Screen it several times and make pressed stars. The stars can be baked in an oven at 135°C for 20 minutes, which will result in much harder, more ignitable, more intensely colored stars. Heating the stars is not recommended though, since it could cause the stars to ignite.

Ammonium perchlorate.....75
"Super Sculpy".....25

White star #1
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium Nitrate.....58
Aluminum.....40
Dextrin.....2

White star #2
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium Perchlorate.....40
Magnesium.....32
Sulfur.....16
Charcoal.....12

White star #3
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium Perchlorate.....2
Aluminum.....1

White star #4
Source: rec.pyrotechnics
Comments:
Preparation:

Barium Nitrate.....53
Potassium Nitrate.....12
Magnesium 100-200 mesh.....28
Parlon.....7
Acetone.....qs
50/50 alcohol/water.....qs

White star #5
Source: rec.pyrotechnics
Comments:
Preparation:

Barium or Strontium Nitrate.....60
Magnesium.....20
PVC.....20

White star #6
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium nitrate.....59
Sulfur.....30
Meal powder.....11

White star #7
Source: rec.pyrotechnics

Comments:
Preparation:

Potassium perchlorate.....61
Aluminum.....31
Lycopodium.....8

White star #8
Source: "The Pyroguide" (a document found on internet)
Comments: Bind with dextrin in water
Preparation:

Potassium nitrate.....6
Sulfur.....1
Antimony sulfide.....2

White star #9
Source: rec.pyrotechnics, posted by Tommy Hakomaki <tommy.hakomaki@mailbox.swipnet.se.
Comments:
Preparation:

Potassium nitrate.....42
Sulfur.....18
Mealpowder.....18

White star #10
Source: rec.pyrotechnics. Post by Erik D. Suni <esuni@lk-hp-26.hut.fi. Composition from "The best of AFN II"[14].
Comments: Meal powder priming should be sufficient.
Preparation:

Potassium nitrate.....28
Antinony sulfide.....6
Sulfur.....8
Dextrin.....1.5

Brilliant white star
Source: "The Pyroguide" (a document found on internet)
Comments: Bind with dextrin in water
Preparation:

Potassium perchlorate.....4
Aluminum dust.....4
Dextrin.....1

Orange star #2
Source: rec.pyrotechnics
Comments: These compositions are part of a matched set invented by Robert Veline. The compositions mix compatibly to produce a wide range of other colors. Examples are given below. The wood meal in the prime (see miscellaneous compositions) makes the stars a little 'fuzzy', making the stars much more easy to ignite. Without the wood meal prime the stars are often blown blind.
Preparation:

Potassium Perchlorate.....75
Cryolite.....10
Shellac.....15

Yellow star #8
Source: rec.pyrotechnics
Comments: These compositions are part of a matched set invented by Robert Veline. The compositions mix compatibly to produce a wide range of other colors. Examples are given below. The wood meal in the prime (see miscellaneous compositions) makes the stars a little 'fuzzy', making the stars much more easy to ignite. Without the wood meal prime the stars are often blown blind.
Preparation:

Potassium Perchlorate.....70
Cryolite.....10
PVC.....10
Shellac.....10

Veline's red star
Source: rec. pyrotechnics, post by Lloyd E. Sponenburgh <lloyds@fiscalinfo.com. This set of compositions was invented by Robert Veline and is used in Kosankie's 'Chemistry of Fireworks (Chemistry of color) class'.
Comments: These compositions are part of a matched set invented by Robert Veline. The compositions mix compatibly to produce a wide range of other colors. Examples are given below. The wood meal in the prime (see miscellaneous compositions) makes the stars a little 'fuzzy', making the stars much more easy to ignite. Without the wood meal prime the stars are often blown blind.
Preparation: Summary of Robert Veline's own comments: "Potassium perchlorate is a fine powder. Parlon is Hercules brand or Superchlon brand from Ishihara co. ltd. Red gum is a fine powder. Copper(II)oxide may be substituted by copper carbonate without much change in performance. Calcium carbonate is 200 mesh, 'Whiting'. More pure forms slow the burn rate and degrade the color."

Potassium perchlorate.....55
Strontium carbonate.....15
Parlon.....15
Red gum.....9
Magnalium (50/50), 200 mesh.....6
Dextrin.....+4

Veline's orange star
Source: rec. pyrotechnics, post by Lloyd E. Sponenburgh <lloyds@fiscalinfo.com. This set of compositions was invented by Robert Veline and is used in Kosankie's 'Chemistry of Fireworks (Chemistry of color) class'.
Comments: These compositions are part of a matched set invented by Robert Veline. The compositions mix compatibly to produce a wide range of other colors. Examples are given below. The wood meal in the prime (see miscellaneous compositions) makes the stars a little 'fuzzy', making the stars much more easy to ignite. Without the wood meal prime the stars are often blown blind.
Preparation: Summary of Robert Veline's own comments: "Potassium perchlorate is a fine powder. Parlon is Hercules brand or Superchlon brand from Ishihara co. ltd. Red gum is a fine powder. Copper(II)oxide may be substituted by copper carbonate without much change in performance. Calcium carbonate is 200 mesh, 'Whiting'. More pure forms slow the burn rate and degrade the color."

Potassium perchlorate.....55
Calcium carbonate.....15
Parlon.....15
Red gum.....9
Magnalium (50/50), 200 mesh.....6
Dextrin.....+4

Veline's green star
Source: rec. pyrotechnics, post by Lloyd E. Sponenburgh <lloyds@fiscalinfo.com. This set of compositions was invented by Robert Veline and is used in Kosankie's 'Chemistry of Fireworks (Chemistry of color) class'.
Comments: These compositions are part of a matched set invented by Robert Veline. The compositions mix compatibly to produce a wide range of other colors. Examples are given below. The wood meal in the prime (see miscellaneous compositions) makes the stars a little 'fuzzy', making the stars much more easy to ignite. Without the wood meal prime the stars are often blown blind.
Preparation: Summary of Robert Veline's own comments: "Potassium perchlorate is a fine powder. Parlon is Hercules brand or Superchlon brand from Ishihara co. ltd. Red gum is a fine powder. Copper(II)oxide may be substituted by copper carbonate without much change in performance. Calcium carbonate is 200 mesh, 'Whiting'. More pure forms slow the burn rate and degrade the color."

Potassium perchlorate.....30
Barium nitrate.....24
Barium carbonate.....15
Parlon.....15
Red gum.....5
Magnalium (50/50), 200 mesh.....11
Dextrin.....+4

Veline's blue star
Source: rec. pyrotechnics, post by Lloyd E. Sponenburgh <lloyds@fiscalinfo.com. This set of compositions was invented by Robert Veline and is used in Kosankie's 'Chemistry of Fireworks (Chemistry of color) class'.
Comments: These compositions are part of a matched set invented by Robert Veline. The compositions mix compatibly to produce a wide range of other colors. Examples are given below. The wood meal in the prime (see miscellaneous compositions) makes the stars a little 'fuzzy', making the stars much more easy to ignite. Without the wood meal prime the stars are often blown blind.
Preparation: Summary of Robert Veline's own comments: "Potassium perchlorate is a fine powder. Parlon is Hercules brand or Superchlon brand from Ishihara co. ltd. Red gum is a fine powder. Copper(II)oxide may be substituted by copper carbonate without much change in performance. Calcium carbonate is 200 mesh, 'Whiting'. More pure forms slow the burn rate and degrade the color."

Potassium perchlorate.....55
Copper(II)oxide.....15
Parlon.....15
Red gum.....9
Magnalium (50/50), 200 mesh.....6
Dextrin.....+4

Veline's mixed colors
Source: rec. pyrotechnics, post by Lloyd E. Sponenburgh <lloyds@fiscalinfo.com.
Comments: These are a few examples of the colors that can be obtained by mixing a few of Robert Veline's set of star compositions.
Preparation:

Yellow.....55 green, 45 orange
Chartreuse.....80 green, 20 orange
Aqua.....80 green,20 blue
Turquoise.....55 green, 45 blue
Magenta.....50 red, 50 blue
Maroon.....85 red, 15 blue
Peach.....60 orange, 25 red, 15 blue
Purple.....5 orange, 15 red, 80 blue

Chapter 9: effect stars

White flare star
Source: "Vuurwerk door de eeuwen heen"[11]
Comments: Dangerous mixture since it contains both sulfur and a chlorate.
Preparation: Wet with solution of shellac in ethanol. ±20g Shellac per liter of ethanol.

Potassium nitrate.....165
Sulfur.....31
Barium nitrate.....455
Barium chlorate.....31
Magnesium powder.....18
Aluminum medium course.....5
Aluminum fine.....25

Gold flitter star
Source:
Comments: The particle sizes of aluminum powders will markedly affect the result. If Al bronze is available, you can use all 16 parts of it instead of the two different Al powders.
Preparation: Add water and proceed as usual.

Potassium nitrate, fine.....16
Sulfur.....3
Charcoal, powdered.....2
Sodium oxalate or Ultramarine.....4 or 2
Fine, grey aluminum powder (preferably pyro Aluminum).....11
Flake Aluminum or medium Al powder (Al bronze works well).....5
Dextrin.....4

Zinc spreader star #1
Source: "The Pyroguide" (a document found on internet)
Comments: The stars spread pieces of burning zinc and charcoal. These stars are much heavier than usual, and require larger lifter charges if they're to be fired from a tube.
Preparation: Bind with water.

Zinc dust.....72
Potassium chlorate.....15
Potassium dichromate.....12
Granular charcoal.....12
Dextrin.....2

Zinc spreader star #2
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with dextrin in water.

Potassium nitrate.....14
Zinc dust.....40
Charcoal.....7
Sulfur.....4

Zinc spreader star #3
Source: "The Pyroguide" (a document found on internet)
Comments: Bind with dextrin in water.
Preparation:

Potassium chlorate.....5
Potassium dichromate.....4
Charcoal, medium.....4
Zinc dust.....24

Willow tree star
Source: "The Pyroguide" (a document found on internet)
Comments: Dangerous mixture since it contains both sulfur and a chlorate.
Preparation: Bind with dextrin in water.

Potassium chlorate.....10
Potassium nitrate.....5
Sulfur.....1

Lampblack.....18

Soft willow lampblack star
Source: "Mesquite charcoal" from Tom Perigrin's homepage.
Comments:
Preparation: Use a meal powder prime. 1 part shellac can be used instead of 5 parts, burning time will be reduced by 2 sec. Standard willow method: mix the components, wet with alcohol/water screen pulverone style, dry, mill for 3 hours then make cut stars. Adding extra charcoal might slow the burn, giving a better tail.

Charcoal.....25
Dextrin.....5
Potassium nitrate.....10
Potassium perchlorate.....30
Lampblack.....30
Shellac.....5

Lampblack willow star
Source: PML, post by Bill Ofca <ofca@csbh.mhv.net
Comments:
Preparation: Dampen with 50/50 water/alcohol as it is rolled over a (chlorate) core star or stars containing NO sulfur or sulfur compounds. It helps to slightly dampen the lampblack with pure alcohol before it is mixed with the other dry ingredients. Once thoroughly mixed, it should still flow as a powder, or too much alcohol was used. If that happens, allow it to evaporate for awhile until it can be sprinkled on the rolling stars.

Lampblack.....12
Potassium chlorate.....8
Potassium nitrate.....1
Dextrin.....1

Silver shower star #1
Source:
Comments:
Preparation: Add water and proceed as usual. The particle size and surface area of the reactants has a profound effect on the results.

Potassium nitrate.....35
Fine charcoal.....8
Boric acid.....2
Sulfur.....7
Potassium perchlorate.....60
Fine pyro Aluminum (atomised Aluminum, 0.1 mm)....20
Fine flake aluminum (Al bronze).....25
Coarse flake Aluminum.....15
Dextrin.....10

Silver shower star #2
Source: PML, post by Charley Wilson <cwilson@celsvr.stortek.com.
Comments: The particle size of the aluminum is not very critical.
Preparation: Dissolve shellac in boiling ethanol, mix in the other ingredients and proceed as usual. Shellac stars take a long time to dry; try drying in the sun. Prime with a perchlorate based strobe prime.

Ammonium perchlorate.....65
Fine aluminum powder or flake aluminum (not too coarse).....22
Shellac.....18

Silver shower star #3
Source:

Comments:
Preparation: Add water and proceed as usual.

Flitter Aluminum (or any grade except the finest pyro grades).....15
Potassium nitrate.....55
Boric acid.....2
Fine charcoal.....10
Dextrin.....5

Electric star #1
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with dextrin in water.

Potassium nitrate.....15
Aluminum, fine.....2
Aluminum, medium.....1
Black powder.....2
Antimony sulfide.....3
Sulfur.....4

Electric star #2
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with red gum in water.

Potassium chlorate.....60
Barium nitrate.....5
Aluminum, fine.....9
Aluminum, medium.....4
Aluminum, coarse.....3
Charcoal.....2
Dextrin.....5

Electric star #3
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with shellac in alcohol.

Potassium perchlorate.....6
Barium nitrate.....1
Aluminum.....20
Dextrin.....1

Electric star #4
Source: "The Pyroguide" (a document found on internet)
Comments:
Preparation: Bind with shellac in alcohol.

Potassium perchlorate.....4
Aluminum, medium.....2
Dextrin.....1

Firefly #1
Source: rec.pyrotechnics archive. Posted by Eric Eisack.

Comments:
Preparation: Aluminum is large flake. It was sieved through a windowscreen. This gives about 30 mesh powder.

Potassium nitrate.....50
Charcoal,air float.....29
Charcoal, 80 mesh.....10.5
Sulfur.....6
Aluminum (large flake).....4.5
Dextrin or CMC.....+5 or +1

Firefly #2
Source: rec.pyrotechnics archive. Posted by Dan Bucciano.
Comments: Can also be used as rocket propellant: Mix the chemicals, dampen, and granulate through a 20 mesh screen and dry. Use +3% by weight as a tail effect. Once you have passed the top core of the rocket by 1/2 inch, you may ram 100% firefly formula the rest of the way. You will end up with a beautiful long trailing tail of firefly.
Preparation:

Potassium Nitrate.....47
Air Float Charcoal.....33
Antimony tri-sulfide.....5.8
Aluminum (400 mesh,12 micron, spherical).....4.2
Sulfur.....4.7
Dextrin.....5.2

Firefly #3
Source: PML Digest 391, post by L.Niksch <LNiksch@aol.com. This formula is provided with the "firefly aluminum" from Skylighter.
Comments:
Preparation: Ball mill potassium nitrate, Air Float charcoal, sulfur and Dextrin together for 1 hour. Then add the 36 mesh Charcoal and firefly aluminum and mix with a spoon. Add water to make a dough mix and cut with a knife into 3/8" cut stars. Separate stars and dry for 3-4 days. The effect is a long tiger tail going up and firefly sparkles coming down. Larger stars take longer to dry, and a damp star produces very little firefly effect.

Potassium nitrate.....49
Charcoal, air float.....29
Charcoal, 36 Mesh.....11
Sulfur.....9
Dextrin.....10
Aluminum, firefly.....5

Glitter star
Source: rec.pyrotechnics archive, post by Tommy Hakomaki <tommy.hakomaki@mailbox.swipnet.se
Comments:
Preparation: Wet with ethanol/water (70/30)

Potassium nitrate.....55
Aluminum 200-400 mesh.....5
Dextrin.....4
Antimony(III)sulfide.....16
Sulfur.....10
Lampblack.....10

Red Pill Box star
Source: rec.pyrotechnics archive. Composition from Lancaster[2]
Comments:
Preparation:

Potassium chlorate.....64
Strontium carbonate.....19
Red gum.....13
Dextrin.....4

Sparkler star
Source: rec.pyrotechnics archive.
Comments: Use course aluminum, fine aluminum will only result in a flash.
Preparation:

Potassium perchlorate.....60
Aluminum, course.....30
Dextrin.....10

White flitter star
Source: Tom’s Perigrin's homepage. Composition from Weingart[5].
Comments:
Preparation:

Potassium nitrate.....17
Sulfur.....3
Charcoal.....3
Aluminum, course.....4
Aluminum flake, fine.....10
Dextrin.....1

White comet #1
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium nitrate.....96
Fine charcoal.....44
Sulfur.....15
Dextrin.....10

White comet #2
Source: rec.pyrotechnics
Comments:
Preparation:

Potassium nitrate.....40
Fine charcoal.....24
Sulfur.....8
Dextrin.....9

'Dragon eggs' star (Crackling star)
Source: rec.pyrotechnics. Composition from "The best of AFN III"[12], page 121
Comments: Sometimes, Bi_2O_3 is used instead of Pb_3O_4. The composition is extremely sensitive, both to friction and impact. It is also quite poisonous and explosive. Gloves and an air mask must be worn at all times when handling this mixture since the mixture contains the very toxic Pb_3O_4.
Preparation: Add lacquer untill the thickness is like wood putty. Pass the mix through a screen and dry it to make 1mm squares. These will explode with a sharp crack shortly after lighting and can be used as star cores.

Pb3O4.....81.8
Magnalium (50/50, 100-200 Mesh).....9.1
Copper(II)oxide.....9.1
Nitrocellulose lacquer binder.....10% by volume

Blue star with charcoal tail
Source: rec.pyrotechnics, posted by sweden <sweden@synchron.ct.se. Source of this composition is Bruce Snowden
Comments:
Preparation: Add isopropyl alcohol for binding. Cut, round and pumped stars can be made with this composition, but a typical KClO4/Red gum/ Charcoal/dextrin prime will be necessary. A final layer of sodium nitrate/sulfur/Charcoal (85/5/10), moistened with NC/acetone lacker (w. about 3% NC) can be added. This adds yellowish sparks. Mealpowder can be used instead if the yellow sparks are not desired.

Ammonium perchlorate.....70
Basic copper carbonate.....10
Red Gum.....10
Charcoal.....10
Dextrin.....+5

Electric purple star
Source: Quoted in an AFN Yearbook from David Bleser on "Protecting Electric Puple Decomposition"
Comments: When very fine powdered ammonium perchlorate was used in a an attempt to try to increase the burning rate of stars an ammoniacal smell and an increase in temperature was noticed. The batch of stars was safely disposed of. By adding 5% potassium dichromate and 1% boric acid the reactions were prevented.
Preparation:

Ammonium perchlorate.....68
Copper benzoate.....8
Strontium carbonate.....12
Magnalium (200-400 Mesh).....5
Hexamine.....7
Dextrin.....+5

Brilliant core
Source: Composition from Shimizu[1], page 219.
Comments: This composition can be used for the cores of round stars. It gives a strong flash of light. The cores burn quickly and are self propelled when they are unevenly ignited. To prevent that, these cores should be coated with 'Brilliant core prime' (see miscellaneous compositions) untill they are round.
Preparation:

Barium nitrate.....66
Aluminum, fine flake.....27
Boric acid.....1
Soluble glutinous rice starch.....6

Silver star core
Source: Composition from Shimizu[1], page 220.
Comments: This composition can be used for the cores of round stars. It burns less quickly than the ‘brilliant core’, and produces a silver flame.
Preparation:

Potassium perchlorate.....56
Rosin (BL combustion agent).....5
Aluminum (fine flake).....32
Lampblack.....2
Soluble glutinous rice starch.....5

Silver wave
Source: Composition from Shimizu[1], page 220.
Comments: This composition produces a silver fire dust. A large silver fire dust flame of short duration is obtained. When the ratio perchlorate to aluminum is changed to 35/65 a small flame with yellowish fire dust of long duration is obtained.
Preparation:

Potassium perchlorate.....50
Aluminum (somewhat coarse flake).....50
Soluble glutinous rice starch.....+5%

Golden wave #1
Source: Composition from Shimizu[1], page 221
Comments:
Preparation:

Potassium nitrate.....37
Aluminum (somewhat coarse flake).....47
Antimony trisulfide.....9
Boric acid.....1
Soluble glutinous rice starch.....6

Golden wave #2
Source: Composition from Shimizu[1], page 221.
Comments:
Preparation:

Potassium nitrate.....37
Aluminum (somewhat coarse flake).....47
Sulfur.....9
Boric acid.....1
Soluble glutinous rice starch.....6

Golden wave #3
Source: Composition from Shimizu[1], page 221.
Comments: A somewhat reddish gold effect is obtained with this composition.
Preparation:

Potassium nitrate.....37
Aluminum (somewhat coarse flake).....47
Realgar.....9
Boric acid.....1
Soluble glutinous rice starch.....6

Golden chrysanthemum
Source: Composition from Shimizu[1], page 221.
Comments: This produces a brilliant yellow fire dust.
Preparation:

Potassium nitrate.....40
Aluminum (somewhat coarse flake).....30
Sulfur.....10
Realgar.....10
Hemp coal (or pauownia coal).....2
Boric acid.....1
Soluble glutinous rice starch.....7

Charcoal fire dust #1
Source: Composition from Shimizu[1], page 221. Listed under the name "Chrysanthemum 6". The 6 in that name comes from the ratio of charcoal to potassium nitrate, which is 6:10.
Comments: A reddish fire dust is obtained, which is relatively shortlived. When willow charcoal is used instead of pine, long lived fire dust is obtained.
Preparation: To obtain the fire dust, the potassium nitrate must be soaked into the charcoal. Hence a wet proces must be used for mixing.

Potassium nitrate.....55
Sulfur.....7
Pine charcoal.....33
Soluble glutinous rice starch.....5

Charcoal fire dust #2
Source: Composition from Shimizu[1], page 221. Listed under the name "Chrysanthemum 8". The 8 in that name comes from the ratio of charcoal to potassium nitrate, which is 8:10.
Comments: A reddish fire dust is obtained, which is relatively shortlived. When willow charcoal is used instead of pine, long lived fire dust is obtained.
Preparation: To obtain the fire dust, the potassium nitrate must be soaked into the charcoal. Hence a wet proces must be used for mixing.

Preparation: Potassium nitrate.....49
Sulfur.....6
Pine charcoal.....40
Soluble glutinous rice starch.....5

Charcoal fire dust #3
Source: Composition from Shimizu[1], page 221. Listed under the name "Chrysanthemum of mystery".
Comments: A weak fire dust is obtained since the composition contains no sulfur. It creates a different and lonely effect.
Preparation: To obtain the fire dust, the potassium nitrate must be soaked into the charcoal. Hence a wet proces must be used for mixing.

Potassium nitrate.....45
Pine charcoal.....50
Soluble glutinous rice starch.....5

Charcoal fire dust #4
Source: Composition from Shimizu[1], page 221. Listed under the name "Tiger tail".
Comments:
Preparation: To obtain the fire dust, the potassium nitrate must be soaked into the charcoal. Hence a wet proces must be used for mixing.

Potassium nitrate.....44
Sulfur.....6
Pine charcoal.....44
Soluble glutinous rice starch.....6

Charcoal fire dust #5
Source: Composition from Shimizu[1], page 221. Listed under the name "Willow".
Comments:
Preparation: To obtain the fire dust, the potassium nitrate must be soaked into the charcoal. Hence a wet proces must be used for mixing.

Potassium nitrate.....35
Sulfur.....12
Pine charcoal.....45
Soluble glutinous rice starch.....8

Silver wave chrysanthemum

Source: Composition from Shimizu[1], page 222.
Comments: A fire dust with sparks from the metal powder is obtained. It looks as if red, yellow and green twinkling fire particles were mixed together.
Preparation: The potassium nitrate, sulfur and pine charcoal are previously mixed densily as in the manufacture of black powder.

Potassium nitrate.....50
Sulfur.....17.5
Pine charcoal.....7.5
Aluminum (somewhat coarse flake).....7.5
Magnalium.....1.5
Antimony trisulfude.....2.5
Realgar.....7.5
Soluble glutinous rice starch.....6.0

Metal fire dust No.32
Source: Composition from Shimizu[1], page 221. Listed under the name "Winokur's compositions". They originated from "The pyrotechnic phenomenon of glitter" by R. M. Winokur from Pyrotechnica No 2, february 1978
Comments:
Preparation:

Potassium nitrate.....38
Sulfur.....13
Charcoal.....10
Barium nitrate.....14
Aluminum, Atomized.....12
Red Iron Oxide, Fe2O3.....8
Dextrin.....5

Metal fire dust No.33
Source: Composition from Shimizu[1], page 221. Listed under the name "Winokur's compositions". They originated from "The pyrotechnic phenomenon of glitter" by R. M. Winokur from Pyrotechnica No 2, february 1978
Comments:
Preparation:

Potassium nitrate.....43
Sulfur.....10
Charcoal.....10
Barium nitrate.....13
Aluminum, Atomized.....13
Red Iron Oxide, Fe2O3.....7
Dextrin.....4

Metal fire dust No.34
Source: Composition from Shimizu[1], page 221. Listed under the name "Winokur's compositions". They originated from "The pyrotechnic phenomenon of glitter" by R. M. Winokur from Pyrotechnica No 2, february 1978
Comments:
Preparation:

Potassium nitrate.....40
Sulfur.....10
Charcoal.....10
Barium nitrate.....16
Aluminum, Atomized.....12
Red Iron Oxide, Fe2O3.....7
Dextrin.....5

Metal fire dust No.35
Source: Composition from Shimizu[1], page 221. Listed under the name "Winokur's compositions". They originated from "The pyrotechnic phenomenon of glitter" by R. M. Winokur from Pyrotechnica No 2, february 1978
Comments:
Preparation:

Potassium nitrate.....36
Sulfur.....13
Charcoal.....10
Barium nitrate.....16
Aluminum, Atomized.....12
Red Iron Oxide, Fe2O3.....8
Dextrin.....5

Metal fire dust No.38
Source: Composition from Shimizu[1], page 221. Listed under the name "Winokur's compositions". They originated from "The pyrotechnic phenomenon of glitter" by R. M. Winokur from Pyrotechnica No 2, february 1978
Comments:
Preparation:

Potassium nitrate.....40
Sulfur.....12
Charcoal.....12
Barium nitrate.....13
Aluminum, Atomized.....12
Red Iron Oxide, Fe2O3.....7
Dextrin.....4

Matrix comet composition #1
Source: PML 8 oct 96, post by Myke Stanbridge <mykestan@cleo.murdoch.edu.au
Comments: A matrix comet consists of a matrix composition in which colored microstars are embedded. It produces a colored tail when fired. The microstars must be slow-burning while the matrix must be very fast burning. The matrix must either emit as little light as possible or a lot of light in a color that is compatible with the color of the microstars. The following green matrix composition from c1995 is a good starting point for further experimentation.
Preparation: Exfoliated mica is also called Vermiculite. It is usually obtained from 'mineral products' suppliers in graded sizes from around 5 to 10 millimetres. It requires comminution in a coffee mill, followed by screening. The guar binder, although very effective in low amounts, has a very slow drying profile and a tendency to produce a 'skin' that prevents 'radiant heat source' drying. To dry the comets uniformly requires a fan circulated 'dry air' drier. Large 3" comets might take two months to dry properly depending on the circumstances.

Potasium chlorate, passing 200 mesh.....50
Barium benzoate, passing 100 mesh.....23
Barium carbonate, passing 200 mesh.....10
Exfoliated mica, pass 80 mesh, hold 120 mesh.....10
Bentonite clay - wyoming, passing 200 mesh.....6
Guar gum fine WW250F, passing 200 mesh.....1

Matrix comet composition #2
Source: PML 8 oct 96, post by Myke Stanbridge <mykestan@cleo.murdoch.edu.au
Comments: A matrix comet consists of a matrix composition in which colored microstars are embedded. It produces a colored tail when fired. The microstars must be slow-burning while the matrix must be very fast burning. The matrix must either emit as little light as possible or a lot of light in a color that is compatible with the color of the microstars. The following green matrix composition from c1995 is a good starting point for further experimentation.
Preparation: Exfoliated mica is also called Vermiculite. It is usually obtained from 'mineral products' suppliers in graded sizes from around 5 to 10 millimetres. It requires comminution in a coffee mill, followed by screening. The guar binder, although very effective in low amounts, has a very slow drying profile and a tendency to produce a 'skin' that prevents 'radiant heat source' drying. To dry the comets uniformly requires a fan circulated 'dry air' drier. Large 3" comets might take two months to dry properly depending on the circumstances.

Potasium perchlorate, passing 100 mesh.....50
Zirconium silicate, passing 325 mesh.....30
Polykarbenite-3 - Armex, passing 200 mesh.....10
Barium carbonate, passing 200 mesh.....9
Guar gum fine WW250F, passing 200 mesh.....1

Chapter 10: strobe stars

Twinkling green star #1
Source: rec.pyrotechnics, posted by Bill Nelson <billn@peak.org, from "Pyrotechnica VII"[3] by T. Fish
Comments: Magnesium reacts slowly with ammonium perchlorate producing ammonia and magnesium perchlorate, especially in the presence of moisture. Thus, the twinklers cannot be stored for more than 6 months, and they must be kept in a closed bag. During the smoulder phase, magnesium reacts with ammonium perchlorate in the dark. In the flash phase, magnesium reacts with barium sulfate, producing hot MgO and creating a green flame. The flash is followed by another cycle, since the flash rapidly consumes the reactants in the flash zone.
Preparation: 1) Binder solution: Dissolve 3 parts of nitrocellulose (smokeless powder or celluloid film) into 30 parts (w/v) of boiling acetone. If you're going to prepare these stars more than once, prepare more of the solution, since nitrocellulose dissolves slowly even in refluxing acetone. Approx. 30 parts of the solution (v/w) is used each time. Nitrocellulose is used as a binder, since other binders tend to interfere with the twinkling. 2) Mix the ingredients into the binder solution in the order they appear here. Proceed as usual. Note that acetone evaporates very rapidly and the stars usually dry within a few hours.

Magnesium powder (any lab grade powder).....23
Ammonium perchlorate.....60
Barium sulfate.....17

Twinkling green star #2
Source: Composition from Shimizu[1], page 224. Listed as "Twinklers of the ammonium perchlorate base, green"
Comments: Frequenty: 3.1 Hz.
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnesium, 60 mesh (treated with potassium bichromate).....23
Ammonium perchlorate.....60
Barium sulfate.....17
Potassium dichromate (as a stabilizer).....+5%

Twinkling green star #3
Source: Composition from Shimizu[1], page 225. Listed as "Twinklers of the nitrate base, green"
Comments:
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnalium.....18 (coated with linseed oil) Barium nitrate[40
BHC (Benzene hexachloride).....5
Sulfur.....30
Antimony trisulfide.....7
•Twinkling red star Class:10.....50

Twinkling red star
Source: PML 383, composition comes from a post to rec.pyrotechnics by Myke Stanbridge <mykestan@cleo.murdoch.edu.au in '95
Comments:
Preparation: Magnesium was treated with cold 10% w/w K2Cr2O7 in deionised water for 2 hours.

Ammonium perchlorate, 100 mesh.....50
Magnesium metal, 120 mesh.....23
Strontium sulfate, 100 mesh.....18
Genchlor GC 700-200, 160 mesh.....2
Winchester DB-231 as grain pwd.....7
Acetone, water free technical.....+20% (w/w)

Twinkling white star #1
Source: PML, posted by Harry Galliam <HEGilliam@aol.com. Composition from Bleser[13], page 22. Listed as "formulation #26; white strobe".
Comments:
Preparation: The magnalium needs to be treated with potassium dichromate before mixing.

Barium nitrate.....51
Sulfur.....19
Magnalium, 100 Mesh.....18
Potassium nitrate.....7
Dextrin.....5

Twinkling white star #2
Source: Composition from Shimizu[1], page 224. Listed as "Twinklers of the ammonium perchlorate base, white"
Comments: Frequenty: 9.7 Hz.
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnalium, 80 mesh (treated with potassium bichromate).....25
Ammonium perchlorate.....60
Barium sulfate.....15
Potassium dichromate (as a stabilizer).....+5%

Twinkling red star
Source: Composition from Shimizu[1], page 224. Listed as "Twinklers of the ammonium perchlorate base, red"
Comments: Frequenty: 3.5 Hz.
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnesium, 60 mesh (treated with potassium bichromate).....30
Ammonium perchlorate.....50
Strontium sulfate.....20
Potassium dichromate (as a stabilizer).....+5%

Twinkling orange star
Source: Composition from Shimizu[1], page 224. Listed as "Twinklers of the ammonium perchlorate base, orange"
Comments: Frequenty: 6.9 Hz.
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnesium, 60 mesh (treated with potassium bichromate).....30
Ammonium perchlorate.....60
Calcium sulfate.....10
Potassium dichromate (as a stabilizer).....+5%

Twinkling yellow star #1
Source: Composition from Shimizu[1], page 224. Listed as "Twinklers of the ammonium perchlorate base, yellow"
Comments: Frequenty: 3.5 Hz.
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming

composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnesium, 60 mesh (treated with potassium bichromate).....40
Ammonium perchlorate.....50
Sodium sulfate.....10
Potassium dichromate (as a stabilizer).....+5%

Twinkling yellow star #2
Source: Composition from Shimizu[1], page 225. Listed as "Twinklers of the nitrate base, yellow"
Comments:
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnalium (coated with linseed oil).....12
Barium nitrate.....33
Potassium nitrate.....7
BHC (Benzene hexachloride).....11
Sulfur.....27
Antimony trisulfide.....5
Sodium oxalate.....5

Twinkling blue star
Source: Composition in handwriting in the copy of Shimizu[1], present in the library of the Technical University of Delft.
Comments:
Preparation: Add 25 parts 10% nitrocellulose solution in acetone to 100 parts of the composition, and make cut stars. Roll these stars in "priming composition #8", using the same NC paste until stars are round. Add a final layer of black powder in NC paste to ensure ignition.

Magnesium, 60 mesh (treated with potassium bichromate).....23
Ammonium perchlorate.....60
Copper sulfate.....17
Potassium dichromate (as a stabilizer).....+5%

Golden twinkler star
Source: "The Pyroguide" (a document found on internet)
Comments: Bind with water. The stars fall through the air and burn in an "on and off" manner. The effect is spectacular.
Preparation: The stars must be pumped or cut.

Potassium nitrate.....18
Sulfur.....3
Lampblack.....3
Aluminum.....3
Antimony sulfide.....3
Sodium oxalate.....4

Chapter 11: smoke stars

Red smoke star
Source: Shimizu[1], page 226. Listed as "Smoke dye compositions for stars, red"
Comments:
Preparation: Wheat flour can be substituted for milk sugar. Produce as 10mm cut stars, and prime with meal powder.

Potassium chlorate.....28
Milk sugar.....20
Rhodamine B conc.....30
Oil orange.....22
Soluble glutinous rice starch.....+3%

Yellow smoke star #1
Source: Composition from Shimizu[1], page 229. Listed as "Yellow dragon"
Comments: The smoke is more dense than that of dye smoke, but it looks dark yellow against the light of the sun. The smoke is poisonous.
Preparation: Make pressed stars.

Potassium nitrate.....25
Sulfur.....16
Realgar.....59

Yellow smoke star #2
Source: Composition from Shimizu[1], page 228. Listed as "White willow"
Comments:
Preparation:

Potassium nitrate.....48.5
Sulfur.....48.5
Realgar.....3
Charcoal (or hemp coal).....+2%
Soluble glutinous rice starch.....+6%

Yellow smoke star #3
Source: Composition from Shimizu[1], page 229. Listed as "Yellow willow"
Comments:
Preparation: Form into cut stars, and dry them well. Place them in a coating tub. Add a slurry of soluble glutinous rice starch and cover all the surfaces with the paste by shaking the tub. Remove from the tub and place them on gypsum powder. Roll them in it until all the stars are coated with the gypsum. Dry in the sun. Repeat these operations untill the layer of gypsum becomes thicker than 1.5mm. It will be necessary to repeat at least 6 times. When done, bore a hole in each star to introduce the fire in it (with appropiate precautions taken). Prime the hole with black powder paste and dry in the sun. Roll a final layer of soluble glutinous rice starch and meal powder over the stars and dry them thoroughly.

Potassium nitrate.....43
Sulfur.....10
Realgar.....37
Hemp coal (or Paulownia coal).....4
Soluble glutinous rice starch.....6

Green smoke star
Source: Composition from Shimizu[1], page 226. Listed as "Smoke dye compositions for stars, green"
Comments:
Preparation: Wheat flour can be substituted for milk sugar. Produce as 10mm cut stars, and prime with meal powder.

Potassium chlorate.....33
Milk sugar.....27
Oil yellow (Butter yellow).....20
Phthalocyanine blue.....20
Soluble glutinous rice starch.....+3%

Blue smoke star
Source: Composition from Shimizu[1], page 226. Listed as "Smoke dye compositions for stars, blue"
Comments:

Preparation: Wheat flour can be substituted for milk sugar. Produce as 10mm cut stars, and prime with meal powder.

Potassium chlorate.....33
Milk sugar.....27
Phthalocyanine blue.....40
Soluble glutinous rice starch.....+3%

Violet smoke star
Source: Composition from Shimizu[1], page 226. Listed as "Smoke dye compositions for stars, Violet"
Comments:
Preparation: Wheat flour can be substituted for milk sugar. Produce as 10mm cut stars, and prime with meal powder.

Potassium chlorate.....29
Milk sugar.....25
Rhodamine B conc.....13
Oil orange.....16
Phthalocyanine blue.....17
Soluble glutinous rice starch.....+3%

White smoke star #1
Source: Composition from Shimizu[1], page 228. Listed as "White chrysanthemum I"
Comments:
Preparation:

Potassium nitrate.....53
Sulfur.....7
Charcoal (or hemp coal).....32
Lampblack.....8
Soluble glutinous rice starch.....+6%

White smoke star #2
Source: Composition from Shimizu[1], page 228. Listed as "White chrysanthemum II"
Comments:
Preparation:

Potassium nitrate.....66
Realgar.....13
Charcoal (or hemp coal).....5
Lampblack.....5
Soluble glutinous rice starch.....11

White smoke star #3
Source: Composition from Shimizu[1], page 228. Listed as "White willow"
Comments: The smoke is caused by condensation of sulfur vapour.
Preparation: Form into cut stars, and dry them well. Place them in a coating tub. Add a slurry of soluble glutinous rice starch and cover all the surfaces with the paste by shaking the tub. Remove from tge tub and place them on gypsum powder. Roll them in it until all the stars are coated with the gypsym. Dry in the sun. Repeat these operations until the layer of gypsum becomes thicker than 1.5mm. It will be necessary to repeat 6 times. When done, bore a hole in each star to introduce the fire in it (with appropiate precautions taken). Prime the hole with black powder paste and dry in the sun. Roll a final layer of soluble glutinous rice starch and meal powder over the stars and dry them thoroughly.

Potassium nitrate.....48.5
Sulfur.....48.5
Realgar.....3
Charcoal (or hemp coal).....+2%
Soluble glutinous rice starch.....+6%

Literature references

In some cases the original source of the composition is know. In those cases a short references has been made, and the full references are given here.

1. T. Shimizu, "Fireworks: The Art, Science and Technique", Pyrotechnica Publications, Austin, Texas, USA (1981)

2. R. Lancaster, "Fireworks, Principles and Practice", Chemical publishing Co., Inc. New York (1972)

3. "Pyrotechnica", Pyrotechnica publications, Austin, Texas, I(1977)-VI(1980)

4. H. Ellern, "Modern Pyrotechnics", Chemical Publishing Co., Inc. New York (1961)

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6. L.P. Edel, "Mengen en Roeren", 2nd edition (1936)

7. E. L. Palder, "Magic With Chemistry" (1964)

8. Kirk-Othmer "Encyclopedia of Chemical Technology"

9. D. Douwes, "Spelen met Vuur"

10. T.L. Davis, "Chemistry of Powder and Explosives", Wiley, London (1941)

11. J. Lenselink, "Vuurwerk door de eeuwen heen"

12. "The best of AFN III"

13. D. Bleser, "Round Stars and Shells"

14. "The best of AFN II"