

Coloured Glasses

Colour is the light that transmits through or reflects off an object. The colour in glass comes from one, or a combination of factors or materials. Colour is rarely a constant produced by a particular oxide in isolation. The arrangement of electrons surrounding the atoms of a particular colouring material are affected by the light energy and by the magnetic energy of adjacent atoms. The remainder of the batch can have significant effect i.e. NiO in a Soda-Lime batch (or lead or barium) will create brown/grey colours – in a Potash Batch (potassium Carbonate) the nickel will create a violet glass.

The oxidising or reducing atmosphere (furnace conditions) can have a significant effect as some of the colours can exist in the glass in more than one valent state. Iron oxide can reduce to ferrous oxide and produce blue-green or it can oxidise to ferric oxide to produce yellow-greens and browns of bottle glass. Copper oxide is blue-green in oxidised alkaline glass but can be reduced to reds or even to produce a thin metallic layer on the glass surface. Glasses coloured by copper, gold, selenium and silver often need to be reheated to enable the colour to strike. The correct temperature and time required for them to strike varies considerably and will only be right for that furnace, or glory hole, at exactly those conditions, at that humidity, etc. It should be repeatable but over confidence beware. Selenium is a major problem when instead of red-orange a black, brown, green or yellow may appear due to its different valent states depending if oxidised or reduced.

Sometimes several “colouring oxides” are added to create an overall colour i.e. “black” is made up of oxides each affecting light transmission at different wavelengths:- blue, purple, grey, green, red etc. Sometimes two different materials are added which combine together i.e. Cadmium Sulphide and Selenium create Cadmium Selenide which creates a ruby red.

| Colour | Colour Variation | Material (combination) | Conditions |
|--------|---|--|--------------|
| Blues | Blue | CuO & CoO | |
| | Blue (Violet tint) | CoO | |
| | Sky Blue | CuO | |
| | Blue Green | Fe ₂ O ₃ + CoO, CuO + Cr ₂ O ₃ , FeO | |
| Browns | Red to Yellow Brown | MnO ₂ + Fe ₂ O ₃ | Oxidised |
| | Carbon Amber | C + Na ₂ SO ₄ + (FeS ₂) | Reduced |
| | Brown Orange | Se (red) + Fe ₂ O ₃ | Not Oxidised |
| | Brown / Grey | NiO | |
| Grey | Grey | MnO ₂ + Fe ₂ O ₃ + CuO | Oxidised |
| | Grey | NiO + above in Soda-Lime glasses | |
| Green | Antique Green | Fe ₂ O ₃ +(C + Cr ₂ O ₃) | Reduced |
| | Emerald Green | Cr ₂ O ₃ | Reduced |
| | Grass Green | Cr ₂ O ₃ + CuO | Oxidised |
| | Yellow Green | Cr ₂ O ₃ | Oxidised |
| | | Pr ₆ O ₁₁ | |
| | K ₂ Cr ₂ O ₇ | | |
| | U ₃ O ₈ (fluorescent) | Reduced | |

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|--------|-----------------------------|--------------------------------|------------------------|
| | | FeO | Oxidised |
| | Green Blue | FeO | Reduced |
| | | Cr2O3 + CuO | Reduced |
| | Moss Green | Cr2O3 + CoO | Reduced |
| | | Cr2O3 + NiO2 | Reduced |
| | Olive Green | Fe2O3 + CrO3 | Oxidised |
| | | Cr2O3 + MnO2 | Oxidised |
| Yellow | Yellow / Green tint | CdS | Reduced |
| | Intense Yellow | U3O8 + Pr6O11 | Oxidised |
| | Gold Yellow | Se + MnO2 in PbO glasses | |
| | Canary Yellow | TiO2 + Ce2O3 | |
| | Yellow / green fluorescence | U3O8 | Oxidised |
| | Amber Yellow | MnO2 + FeO | Oxidised |
| | | Se in PbO glasses | |
| Orange | Orange Red | CdS + Se | Slightly Reduced |
| | Orange Brown | Se | |
| Rose | Rose / Pink | Se not in PbO glasses | Reduced |
| Red | Ruby | Se + CdS not in PbO glasses | Reduced + on Reheating |
| | | Au | |
| | Copper Ruby or Antique Ruby | Cu2O | Reduced + on Reheating |
| | Red Violet | MnO2 + Se | Oxidised |
| | Wine Red | Nd2O3 + Se | Not Oxidised |
| Black | Black | FeS | |
| | | MnO2+Fe2O3+NiO+CoO+CuO | Oxidised |
| | | Se +CoO | Reduced |
| Violet | Red Violet | MnO2 in Soda Lime Glasses | Oxidised |
| | Blue Violet | MnO2 in Potash Glasses | Oxidised |
| | Violet | NiO in PbO + in Potash Glasses | |
| | Rose Violet | Nd2O3 | |
| | | MnO2 + CoO | Oxidised |
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