

LMHC Information Sheet # 16

Colour stability testing of Gemstones

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Members of the Laboratory Manual Harmonisation Committee (LMHC) have standardised the method to test the colour stability of gemstones.

Definition

The colour of gemstones has various causes such as colouring elements (e.g. chromium in ruby), inclusions (e.g. Ni-compounds in chrysoprase), physical effects (e.g. play-of-colour in opal), or so-called colour centres (e.g. blue topaz or certain corundum varieties).

Colour centres are lattice defects within a crystal structure which may absorb light and result in the colour of a gemstone. Although many colour centres are stable in normal conditions (e.g. for blue topaz or many yellow sapphires), it is possible, that certain colour centres are not stable resulting in a fading-out or shift of colour of a gemstone following a more-or less prolonged exposure to daylight. This is specifically the case for certain padparadscha sapphires and/or fancy sapphires, but also for other minerals such as spodumene, sodalite or zircon, to name a few.

In some of these cases, it is possible to re-activate the colour centre and to re-establish the colour present before fading/shifting. This is usually done by exposing of the stone to UV light with a UV-lamp or sunlight (which contains notable amounts of UV). In this case we talk about a reversible change/shift of colour, also known as reversible photochromism or tenebrescence. Although this can be an intriguing property of a gemstone, it is important for gemmological laboratories and the gem trade alike to test for such possible colour instabilities, as it may finally have an influence on nomenclature (see IS 4: Padparadscha sapphire).

In the following, a method for colour stability testing is described which has been harmonised among the LMHC laboratories.

Method for Colour Stability Testing

Colour stability testing usually involves three main steps:

- 1) A careful **grading of the initial colour** of a gemstone using standardised light (D50, 5000 K to D65, 6500 K) and a colour reference chart (e.g. Munsell colour chart, Color-Codex™, or other appropriate colour grading tool).
- 2) **Exposure of the gemstone to a strong light source** (LED or halogen, with very little to no UV component; suggested 100 W). It is recommended to place the gemstone close to the light source (about 5-10 cm) for a **minimum 3 hours** to check if the colour centre is 'deactivated' and unstable resulting in a possible fading or colour shift.
- 3) A careful **grading of the colour after light exposure** using standardised light (D50, 5000 K to D65, 6500 K) and a colour reference chart (e.g. Munsell colour chart, Color-Codex™, or other appropriate colour grading tool).

In case an activation test is added:

- 4) **Exposure of the gemstone to UV light** (longwave or shortwave) with a **strong UV lamp**. It is recommended to place the gemstone directly on the gemmological UV lamp for **minimum 10 minutes** to check if the colour centre is 'activated' resulting in a possible increase of colour saturation or in a colour shift (back or even further than initially).
- 5) A careful **grading of the colour after UV exposure** using standardised light (D50, 5000 K to D65, 6500 K) and a colour reference chart (e.g. Munsell colour chart, Color-Codex™, or other appropriate colour grading tool).

Only by carrying out the complete testing circle ('deactivation' and 'activation', i.e. step 1 to 5), it is possible to observe and register the full range of a possible shift of saturation or colour hue of a gemstone with a reversible photochromism (tenebrescence).

This colour stability testing is simple and can be carried out at any stage and by any person with basic gemmological knowledge. For gemmological laboratories, it is suggested to register at each grading step (steps 1, 3, 5) an absorption spectrum of the gemstone.

Wording on Reports

The result of the colour stability test shall be mentioned in the comment section of a gemmological report.

There are three options, either

- a) no colour shift,
- b) minor colour shift (e.g. orange to pinkish orange) or
- c) distinct colour shift (e.g. orange to pink).

In case of minor to distinct colour shifts, an activation test (see above steps 4 and 5) is suggested to check whether the colour instability is reversible or not.

In case of a reversible colour shift, the terms **reversible photochromism** or **tenebrescence** may be added in the comment section of a gemmological report.

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