To what an extent a jeweller can identify Treated Diamonds

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Gemstones are treated to achieve an apparently better quality. Quality in diamonds are characterised by the 4 C's (weight, colour grade, purity grade, cut). While improvements in weight are feasible within small limits, they are, however, rarely performed. Improvements in cutting quality, i.e. symmetry and polish, are the easiest improvements to do, but always related with a loss of weight. Improvement of colour and purity is now quite current, and different techniques are available to treat diamonds in the two respects.

As all gemmological identifications strongly depend of the degree of education and skills of the gemmologist, it is evident that not everybody will be successful in the same extent when a treatment is about to be detected. We recommend people from the jewellery trade to participate regularly in courses and practical sessions where they can train their skills and where they are informed about the latest developments in this field.

<u>Improvements of colour</u>

To understand what an improvement in colour grade could mean we have first to look at a graph which was delivered by Prof. Alan Collins (1982). From this graph it becomes visible that diamonds of low saturations of yellow are not in favour and therefore inexpensive. For such stones two solutions are possible: First the colour may be intensified or overlain by a new colour so that the stones end up with a "fancy colour grade". Another solution would be to de-colourise the diamond and bring it to a higher colour grade. Different techniques allow to some extent a shift in colour. They are quickly presented here, in a very incomplete and simplifying way.

Coating

With a deposition of a thin bluish layer the yellow original colour can sometimes be masked. Micro-scratches can identify such coatings.

Irradiation

By irradiation with electrons a new, usually green colour can be generated on the diamond. Often such colours are confined to a surface layer and are visible in soft light. A 741 nm line (GR1) is often visible in the spectroscope. In soft light with low magnification concentrations of green along the girdle or at the culet may be visible.
Intensive irradiation produces so much green that the diamonds may appear black.

Bombardment

A neutron beam may also change the colour of diamond into green. Green diamonds are among the most difficult to identify, because natural irradiation and bombardment also occurs.

Heating

Green diamonds may be heated and then change their colour to yellow, orange or brown. They usually produce a 594 nm line in the spectroscope. Further spectroscopic features are usually necessary to understand the type of diamond, and safely identify the origin of colour. This identification is only possible in a well equipped gemmological laboratory after a thorough spectroscopic analysis at low temperature.

HT Heating

A heat treatment at high temperature in absence of oxygen is often performed on very fractured diamonds. The fissure planes may transform the surface from diamond to carbon. Graphitisation turns the diamonds black.

HPHT (1)
Originally, brown type II diamonds were heated under high pressure and the brown colour component disappears. It may be possible that discoid fissures develop which show graphitisation. However, type II diamonds show a characteristic pattern under crossed polars. The so called "Tatami strain" is a disturbance feature which is also visible in stones not treated by HPHT. A safe identification of HPHT is only possible in a well equipped gemmological laboratory. With an SSEF Type II diamond spotter, type II diamonds can easily be identified by their ability to transmit short wave (266 nm) radiation. Colourless stones which are not of Type II are thus definitely naturally colourless.

HPHT (2)
Originally brown type I diamonds are also treated by HPHT, and they develop a strong greenish yellow color. A safe identification of this treatment is often possible in a well equipped gemmological laboratory after thorough spectroscopic analyses.

Laser drilling
Some diamonds of lower purity degrees are sometimes laser drilled. The drill holes give access to inclusions deep in the stone. The dissolution of included minerals at the end of the drilled channels may turn dark inclusions into bright empty inclusion beds. A more recent method of lasering produces laser channels which do not start at the diamonds surface. Laser treated diamonds can be identified with a loupe or with a microscope at magnifications from 10x to 20x.

Fracture filling
Fissures are among the easiest to see inclusions in diamonds. Fissure planes appear as bright features since they reflect the light totally. When the fissure is filled with a substance of high refractive index (which comes close to that of diamond), its appearance is strongly reduced. Bluish-orangy flashes will allow identification. Often, the filling which contains heavy elements contains gas bubbles, which also help to recognise the filled fissures. Besides near colourless fillers we sometimes encounter whitish fillers which also represent a foreign substance in a diamond.