Pink Diamond TREATMENT

A three-step treatment process produces pink diamonds that look almost natural.

DR. ERIC EREL

Due to the rarity and the high cost of natural-color pink diamonds, there is great interest in methods to produce treated pink diamonds. The latest treatment method involves a complex three-step process: high-pressure/high-temperature (HPHT) annealing, followed by an irradiation with electrons and then a low-temperature annealing. The process can transform a natural light yellow or brown, type Ia — nitrogen-rich — diamond into a fancy color pink, as well as red or purple, diamond. Colored stones produced using this process became commercially available beginning in 2004.

Many gemological and spectroscopic properties that distinguish natural from color-treated diamonds have been previously identified. However, the recent study of a pink color-treated diamond shows, for the first time, that it is possible to treat a diamond in order to create a color distribution with the same aspect as a natural-color pink diamond.

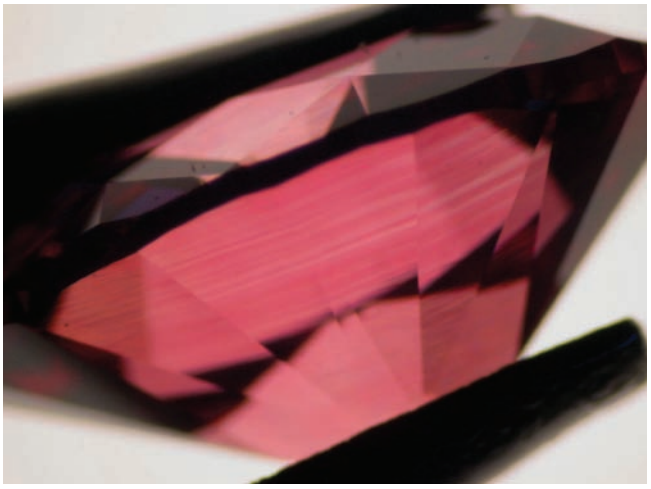
NATURAL-COLOR TYPE Ia PINK DIAMONDS

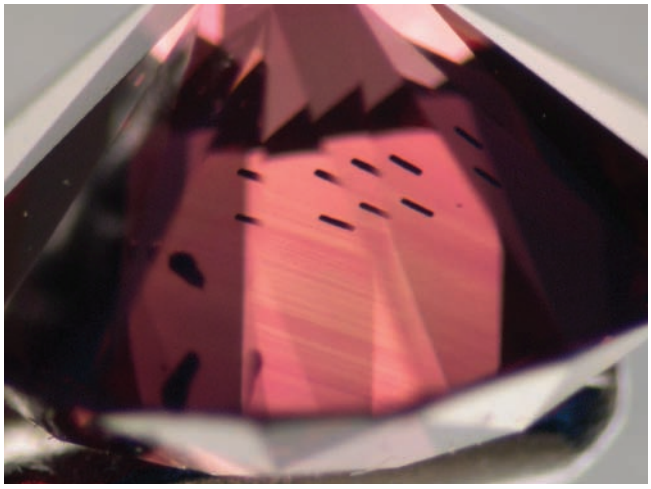
The color zoning observed in natural-color pink, but also red and purple, diamonds is the result of external stress applied to the diamonds during the time they spend in the earth. This stress causes some planes of carbon atoms to slip with respect to each other. As a result of this plastic deformation, these naturally colored diamonds show a color distribution that appears striated. The color planes are oriented in the direction of the slip, so that pink, but also purple or red, planes are seen in an otherwise near-colorless diamond. These striations are commonly called "colored graining" in gemology and are described as characteristic of such natural-color diamonds.

TREATED-COLOR TYPE Ia PINK DIAMONDS

The presence of colored graining is strongly believed to be characteristic of natural-color pink, red and purple diamonds. However, this criterion should be interpreted with care. The recent examination of a 0.36-carat, fancy intense purplish pink diamond illustrates the complexity. Face-up, the treated diamond appears homogeneously colored.

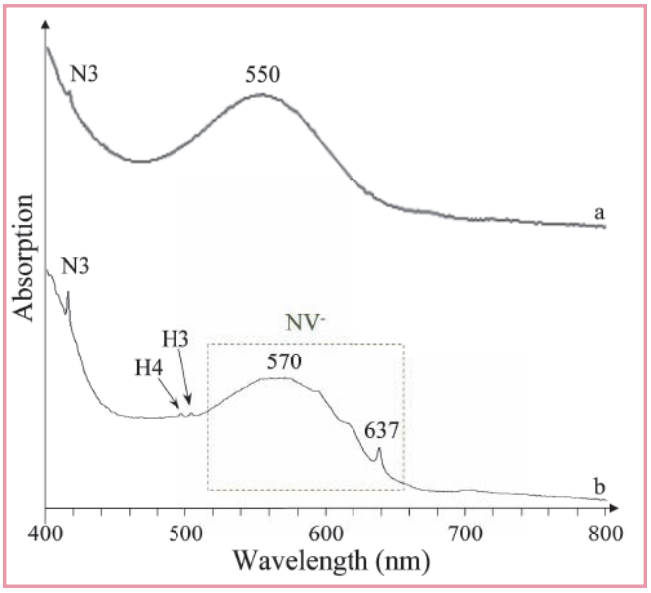
This page: *The 0.36-carat, fancy intense purplish pink, treated-color diamond.* ***Opposite page, top left:*** *Colored graining in a natural-color fancy purplish red diamond. The color is located in parallel planes separated by zones that are near colorless;* ***top right:*** *Colored graining in the 0.36-carat, treated-color fancy intense purplish pink diamond. As in natural-color pink, purple or red diamonds that have undergone plastic deformations, the color of this treated diamond also is located in parallel planes separated by zones that are near colorless. All photos by Eric Erel;* ***bottom****: Absorption spectrum in the visible region of a natural-color pink diamond (a), and of the 0.36-carat, treated-color fancy intense purplish pink diamond (b). The natural-color pink diamond is characterized by the 550 nm absorption band, and the treated one is characterized by the NV^- center — peak at 637 nm and band centered around 570 nm — that is typical of pink and red treated diamonds.*





However, a microscopic examination reveals an uneven color distribution that is identical to the color distribution previously described for a pink diamond of natural color. The color zoning shows a very delicate colored graining, with purplish pink bands of different widths, ranging from very thin to large, running through the whole stone, in an otherwise near-colorless matrix. The color zoning of this treated diamond is very different from that reported previously for a treated diamond. The color zoning for the earlier treated pink to red to purple diamonds consists of a combination of straight, angular and irregular-shaped colored areas.

Dr. Andru Katrusha, of the Institute for Superhard Materials in the Ukraine, and Professor Dr. Heiner Vollstädt, of SedKrist GmbH in Germany, were the two scientists who treated the stone. They carefully selected a light brown natural type Ia diamond that they submitted to HPHT treatment at approximately 2200°C. After HPHT treatment, the stone turned greenish yellow. It was then further irradiated with electrons, which turned the diamond dark green. Finally, in the third step, the diamond was treated with heat at 1000°C for two hours to produce its purplish pink color.



This fancy intense purplish pink diamond is the first treated diamond reported to possess a color distribution identical to that of a natural-color pink, type Ia diamond. Although this stone is small, it opens new possibilities for making treated diamonds look more natural.

IDENTIFICATION

When exposed to both long-wave and short-wave ultraviolet (UV) radiations, the 0.36-carat treated diamond shows a combination of orange and chalky green-yellow fluorescence of weak intensity. Careful examination of the luminescence pattern reveals that the two fluorescence colors are limited to different growth structures. These luminescence reactions are consistent with those previously described for pink, type Ia, color-treated diamonds. On the other hand, when a natural-color pink, type Ia diamond has a luminescence reaction under UV illumination, it is usually blue under long wave and blue or yellow under short wave.

In order to comprehend the color origin of a diamond, the use of a sensitive spectrophotometer is required. The color center associated with pink, red and purple plastically deformed diamonds produces a large absorption band centered at about 550 nanometers (nm). Often, in type Ia diamonds, the N3 color center also can be detected. The presence of both centers is then responsible for the overall color of natural diamonds. With treated diamonds, the pink, purple and red coloration is mainly due to the single nitrogen/single vacancy (NV^-) centers produced during the multistep treatment process. The treated diamond recently studied has an absorption peak at 637 nm and an absorption band centered on 570 nm. Other color centers of weaker intensity, including H3 and H4, also can be observed.

In some cases, a desktop gemological spectroscope may help to identify a treated pink, as well as red or purple, diamond, if the absorption line at 637 nm has sufficient intensity. ✦

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