

Improvement of Vietnam corundum

V.S.Konevsky, L.A.Litvinov, Nguyen Hoang Ngy*

Institute for Single Crystals, National Academy of Sciences of Ukraine,
60 Lenin Ave., 61001 Kharkiv, Ukraine

*Hanoi University of Technology, Hanoi, Vietnam

Received May 31, 2000

Corundum crystals from Vietnam mines have usually a faded color that reduces their value, since the mineral is considered as a gemstone only if it makes an esthetic impression.

As long ago as in the Middle Ages a method for improvement of the precious stone color by means of slow heating has been described by Birooni. At present, most of the natural stones of I and II classes are subjected to the color improvement procedure that enhances their value by one order or two. The improvement of esthetic and decorative quality of jewelry crystals consist as a rule in various processes of color center formation that have not been occurred under natural conditions for any reason.

The purpose of this work is to modify the color of faded rubies and other corundum crystals from Vietnam mines.

The pink sapphires (0.01 % Cr) were the study objects. The crystals were placed in the saturated Co vapor atmosphere at

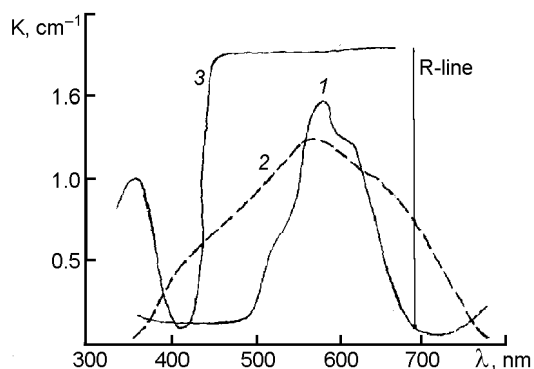


Fig.1. Absorption spectra in visible region: the improved Vietnam sapphire (1), natural blue sapphire (2), CoAl_2O_4 spinel (3).

1000–1200°C. The sample color was compared to the absorption spectrum of natural blue sapphire in the visible range.

The interaction of aluminum and cobalt oxides at 1400°C was studied by Schmalzried [1] who found the spinel compound CoAl_2O_4 . The solid solution region width is almost temperature-independent [2].

The comparison of absorption spectra of the improved blue sapphire and the natural one (Figure) shows that band maxima for both object are coincident. The improved blue sapphires show a weak reddish tinge typical of natural Ceylon sapphires due to presence of a narrow resonance *R* line in the crystal spectrum. This feature is inherent in crystals having the optical density in the absorption maximum less than $1\text{--}1.5\text{ cm}^{-1}$.

The absorption band of CoAl_2O_4 spinel grown by Verneuil technique is in a shorter-wavelength spectral range and the crystal color is violet. Such a considerable difference in spectra (see Figure) evidences that the blue color of improved samples is not associated with the cobalt spinel formation on the surface.

It has been proved in experiment that the color obtained by the improvement is stable against any light, temperature and radiation factors possible in natural environment.

References

1. H.Schmalzried, *Zs. Physik. Chem.*, **28**, 203 (1961).
2. N.A.Toropov, V.P.Barzakovsky, V.V.Lapin et al., *State Diagrams of Silicate Systems: A Reference Book*, 1st Issue: Binary Systems, Leningrad (1969) [in Russian].