

STUDIES ON CHEMISTRY AND COLOUR OF
SOME CORUNDUM MINERALS

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Most corundum minerals are of considerable economic importance to Sri Lanka because of their colour and gem quality. Chemically they contain Al_2O_3 with trace quantities of transition elements in solid solution. Corundum minerals possess $\alpha-Al_2O_3$ structure with the space group $R\bar{3}C$. In the present study chemical composition, crystal parameters and optical absorption spectra of untreated as well as heat-treated samples of different corundum minerals have been investigated.

Chemical analysis of natural corundum samples for transition elements has been carried out by means of atomic absorption spectroscopy and colorimetric methods. The cell parameters of untreated and heat-treated samples were obtained by Power X-ray Diffraction using silicon as an internal standard followed by least square refinement. Heat treatment has been performed under a reducing atmosphere at $1000^\circ C$. Polarized optical absorption spectra of the samples were obtained using a Zeiss PMQ 11 single beam spectrophotometer.

Both blue and white sapphires contain similar amounts of Ti (~ 150 ppm) while blue variety contains a much higher Fe content (~ 3500 ppm). Yellow sapphire is characterized by the presence of high content of Fe (~ 3600 ppm) while ruby contains the highest Cr content (~ 300 ppm) of all the corundum minerals investigated. Unit cell parameters show similarities in the case of white and blue sapphire while ruby and yellow sapphire too show close resemblances. Heat treatment up to $1000^\circ C$ under reducing conditions did not change the unit cell parameters appreciably though colour changes in some cases were visible. Yellow and white samples did not show any pronounced absorption maxima. However, blue sapphire exhibited bands in the range $26,100-17,000\text{ cm}^{-1}$ while ruby bands appeared in the range $24,800-14,500\text{ cm}^{-1}$. By taking analytical data into consideration, these bands have been assigned to various possible d-d and ion transitions.

(Authors thank International Program in the Chemical Sciences of the Uppsala University in Sweden for financial assistance to carry out a part of this work in Sweden.)