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XANES Study of Fe and Ti cations in Blue Sapphires

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X-ray absorption near-edge spectroscopy (XANES) can be used to study oxidation state of dilute system such as transition-metal defect in solid-state samples. In blue sapphire, Fe and Ti are key elements that caused the blue colour. Inter-valence charge transfer (IVCT) between Fe^{2+} and Ti^{4+} has been proposed to describe the optical colour's origin. However, existence of the divalent iron cations has not been thoroughly investigated. Fluorescent XANES is therefore employed to study K-edge absorptions of Fe and Ti cations in various blue sapphire samples, including, natural, synthetic, diffused and heat-treated sapphires. All the samples showed Fe absorption edge at 7124 eV, corresponding to Fe^{3+} state; and Ti at 4984 eV, corresponding to Ti^{4+} . Fe, Ti, and other metal cations in the samples were determined qualitatively by synchrotron X-ray fluorescence spectroscopy (XRF) before the XANES experiments.

Keywords

XANES, XRF, Blue Sapphires

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