

## Oxidation State of Fe in Irradiated Sapphire by XAS Technique

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Corundum (ruby & sapphire) consists of  $\text{Al}_2\text{O}_3$  and trace elements relating to the cause of color such as Cr, Fe, and Ti. Irradiation is one of gemstone enhancements for improving their color appearance. The aim is focused on the oxidation state of Fe ions that concern with the cause of yellow color in irradiated sapphire by XAS technique. In this study, natural sapphire samples from Sri Lanka were collected. The samples were irradiated with high energy electron beam at 40,000 kGy, 60,000 kGy, and 80,000 kGy. XAS technique was emphasized on Fe *K*-edge XANES spectrum. The Fe-chemical standard includes FeO,  $\text{Fe}_2\text{O}_3$ , and  $\text{Fe}_3\text{O}_4$  referred to  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ , and  $\text{Fe}^{2+}, 3+$  respectively. According to the results, the absorption edge position of the Fe *K*-edge XANES spectra detected from the samples is similar to the position from  $\text{Fe}_2\text{O}_3$ . Moreover, the linear combination fitting of Fe ions in the samples compared with the Fe-chemical standard shows that the cause of yellow color on irradiated sapphire samples could be affected by  $\text{Fe}^{3+}$ . Hence, it could be summarized that the increasing of yellow color in irradiated sapphire samples is due to the increasing of high energy electron doses and  $\text{Fe}^{3+}$  ratio.

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