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Surface study of irradiated sapphires using AFM

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The irradiation is one of the gemstone enhancements for improving the gem quality. Typically, there are many varieties of irradiated gemstones in the gem market such as diamond, topaz, and sapphire. However, it is hard to identify the gemstones before and after irradiation. The aim of this study is to analyze the surface morphology for classifying the pre- and post- irradiated sapphires using atomic force microscope (AFM). In this study, the sapphire samples were collected from Thailand and Sri Lanka based on their different geological origins. The samples were irradiated by high energy electron beam for a dose of ionizing radiation at 40,000 kGy. As the results, the surface morphologies of unirradiated sapphires show regular atomic arrangement, whereas, those of irradiated sapphires show the nano-channel observed by the 2D and 3D AFM images. The atomic step height and root mean square roughness have changed after irradiation due to the micro-structural defect on the sapphire surface. Therefore, this study is the frontier application for sapphire identification before and after irradiation.

Primary author: MONARUMIT, Natthapong

Co-authors: JIAVANANTAKA, Pitchaporn (Department of Earth Sciences, Faculty of Science, Kasetsart University); MOGMUED, Jidapa (Department of Earth Sciences, Faculty of Science, Kasetsart University); LHUAAMPORN, Thanapong (The Gem and Jewelry Institute of Thailand (Public Organization)); Dr SATITKUNE, Somruedee (Kasetsart University)

Presenter: MONARUMIT, Natthapong

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