Value Addition of Sri Lankan Dark Spinels through a Heat Treatment Technique

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Ruby, Sapphire, and Emerald are the gem varieties that come under the precious gem category. Therefore, they have a high economic value in the global gem market. Semi-precious gem types are already gaining significant commercial importance in the worldwide gem trade. Gem quality Spinels has a high demand as a semi-precious gem variety. Sri Lanka is very famous for gem-quality Spinels, but apart from that, a high quantity of low gem-quality dark Spinels are found in Sri Lankan gem fields. Currently, the Sri Lankan gem industry is facing the challenge of enhancing the clarity and transparency of dark spinel using heat treatment techniques. Therefore, this study focused on whether the Sri Lankan dark Spinels can be lightened through heat treatment and to develop a heat treatment technique for clarity enhancement of dark Spinels. Spinel samples were analysed to find the content of d block transitional elements which are responsible for the formation of colours in crystals. X-ray fluorescence spectroscopy was used to provide information about the chemical composition and trace element content of Spinel samples. The samples were heat-treated in oxidising and reducing conditions at a temperature ranging from 600° C to 1800° C for 1 hour to 6 hours using the Lakmini gas furnace to find the critical temperature at which Spinels change their current state of transparency. Chemical analysis has proved the dark Spinels primarily consist of high Fe and Zn content. Some rare elements, such as Pt, are also found apart from 3d transitional elements. The critical temperature at which Spinels enhance their clarity was around 1050° C. Prominent clarity enhancement was observed in samples that contained a high percentage of 3d transitional elements such as Mn, Cr, and Cu. The results of this research proved that dark spinel could be value-added by heat treatment.

Keywords: Clarity enhancement, Dark Spinels, Heat treatment, Semi-precious gems, Value addition