

Identification of Heat Treated Natural Blue Spinel Using Raman Spectroscopy

A.D.C. de Silva, R.G.C Jaliya and G. Wijesuriya

Department of Science and Technology, Uva Wellassa University, Badulla, Sri Lanka

Sri Lanka is well known to the world for its vast potential of gem minerals. It is known in the ancient times as “Rathna Dhweepa”– “The Island of Gems”. Almost 75% of the landmass of Sri Lanka is composed of ancient gem-bearing rocks. Sri Lanka produces more than 75 species and varieties of gem minerals. The gem mineral Spinel is found in greater abundance in Sri Lanka as compared to other gem minerals. Most of the naturally occurring blue spinel is dark blue in color. These dark blue spinels have no demand and have a very low market price. Therefore, this study was focused on heat treatment of this low value material, under specific temperatures and atmospheric conditions for certain durations to reduce its color intensity, dissolve colloids and develop methods to identify treated stones from untreated natural stones. Samples of dark blue spinels were heat treated under both reducing and oxidizing atmospheric conditions at a temperature ranging from 600 °C to 1200 °C for 20 minutes to 2 hours. Both treated and untreated samples were then analyzed using Raman Spectroscopy. When the spinels were treated under reducing conditions no changes were observed. Color reduction and clarity enhancement were observed when the stones were treated under oxidizing atmosphere conditions. Dark blue spinel turned into greyish blue in colour with enhanced clarity. Heat treated spinels could be easily identified by Raman Spectroscopy by the width of the 405 m⁻² Raman line. A wider and less intense peak could be observed for treated stones whereas in untreated stones a sharp peak of greater intensity could be observed. The results of this research have proved that dark blue spinels could be lightened and clarified by low temperature heat treatment and identification of treated stones from untreated stones could be done by analyzing through Raman Spectroscopy.

Keywords: Blue spinel, Spinel, Heat treatment, Raman spectroscopy