CHEMICAL AND STRUCTURAL INVESTIGATIONS ON SOME SPINEL GROUP OF MINERALS

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Spinel group of minerals has a wide geologic distribution as accessory minerals and possesses the general formula, AB_2O_4, in which usually A is a divalent cation and B is a trivalent cation[1]. Naturally occurring spinels had been equilibrated under a wide range of temperature and pressure conditions and thus they are very complex compositionally. Various transition metal ions are also incorporated into these structures forming coloured gem quality spinels which are of great economic importance. A bluish-purple sample of spinel has been investigated by Slack[2] who reported the unit cell axis as, a = 8.089Å and the presence of Cr and Zn as impurities. In the present study the chemical composition, crystal chemistry and optical properties of some gem quality spinels occurring in Sri Lanka have been investigated.

Chemical analysis has been performed on 15 different samples by using an automated electron micropobe model Cameca Sx 50. X-ray powder patterns were obtained using Phillips PW 1710 X-ray powder diffractometer with Cu-K_α radiation. UV-visible spectra have been measured using a Zeiss PMQ (2) single beam spectrometer. Heating experiments have been performed using a vertical tube furnace equipped with a quenching device, in the temperature range 500 - 1000°C.

Spinels investigated contain 69.5-71.0% wt. Al_2O_3 and 27.0-28.0% wt. MgO except in samples in which high FeO and ZnO contents are present. All coloured samples were found to contain transition metal ions such as Mn, Fe, Co, Ni, Ti, V & Cr in varying amounts, which are primarily responsible for the colours exhibited by these minerals. Of the transition elements iron is predominant and its concentration was found to be in the range 0.5 - 1.8% wt. The relative abundance of these ions may be approximately represented as Fe>>Zn>Cr,V>Ti>Mn>Co,Ni. In most samples the total content of iron is in the form of Fe^{2+} in tetrahedral positions as detected by Mossbauer Spectroscopy. Crystal system is cubic with the unit cell axis, a, in the range 8.088 - 8.091Å with a cell volume of 529.1 - 529.5Å^3. Cell shrinkage has been observed in heat treated (900°C) and quenched samples. UV-visible spectra of the spinel samples showed absorption bands in the range 17,000 - 26,799 cm^{-1}. However, an appreciable decrease

in intensities of these bands has been observed after heat treatment.

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