Raman spectroscopy of freshy fallen Mahadeva (H5/6)Chondrite

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Introduction: Study of a new chondrite meteorites always shades some insights on the understanding of the records of physical and chemical processes during the early phases of the formation of the Solar System. The chondrites have experienced secondary processes like aqueous alteration, thermal and shock metamorphism and based on that the primary properties of chondritic meteorite have been modified [1]. Type 1 and 2 represents the aqueous alteration whereas type 3 to 6 represents the thermal metamorphism. As thermail metamosphism changes from 4 to 6 a certain diversity in mineral groups while having chemical equilibrium. The Mahadeva meteorite has been classified as ordinary chondrite of type H (5/6) [2]. In the present study we tried to focus on its peterological classification for further ascerating the petrological class of this meteorite using Raman Spectrometer.

Analytical Techniques: Five thick section has prepared for of mineralogy and mineralogical studies. High resolution mosic imgaes of these section were prepared using Scanning Electron Microscope (SEM model JEOL IT300) coupled with Energy Dispersive System (OXFORD instruments) integrated with Micro-Raman Microscope (Hybriscan technologies). The BSE iamges were caputured using optimum operating condition of 15 keV 500 pA. The Raman spectra of various minerals phases with the spot analysis covering 2 μm, has been generated by the Hybriscan Micro-Raman spectrometer using a 20 mW laser power excited wavelength of 785 nm from the various mineral phases.

Results: The processing of the Raman spectra shows characteristic doublet peak at 821.9 cm^{-1} and 852.2 cm^{-1}.which is a characteristic spectra for SiO_4 bonds in Olivine. Similarly presence of pyroxene has been observed in multiple sperctral peaks. These peaks incude a doublet with peak at 660 cm^{-1} and 678 cm^{-1}, 1008 cm^{-1}, 1150 cm^{-1}. We could also able to detect the Raman chanarchterstics peak of K-feldspar are seen at 478 cm^{-1} and 510 cm^{-1}. Apart from silicate phases we analysed metallic oxides like chromite which shows the specral peak at 684 cm^{-1}.

Discussion: The doulet spectra of olivine in Raman sepctra at with peak at 821.9 (A_1)and peak at 852.2(A_2) have full width at half maximum (FWHM) values of the A_1 (spectra for Peak at 821.9 cm^{-1}) olivine band in the Raman spectra of Mahadeva is ~13.2 cm^{-1} which can be correlated with the low degree of crystal structural disorder resulting from shock deformation [3]. The doublet spectra with asymmetric peak at 678cm^{-1} (B_1) is for orthopyroxene (Opx) due to the two types of pyroxene chain [4]. The spectral band in region 1008 cm^{-1} (B_2) is due to the symmetric starching mode of SiO_4 within pyroxene. The cross plot of A_1 vs A_2 shows that the olivine are falytic corresponding to 20 Fa mol % which is consistent with Mahadeva chondride of type H. This is also supported by the cross plot of B2 vs B_1 [5]. The The feldspar peaks observed are mainly characteristics line for K-feldspar [6]. The strongest peak at 684 cm^{-1} is characteristic feature of chromite which has been attributed to the bonds in (Cr^{3+}, Fe^{3+}, Al^{3+})O_6 octahedra [7].

Conclusion: The Raman Specectral analysis of Mahadeva Meteorite supports that Mahadeva is highly equilibriated H chondrite and consistent with the earlier studies.

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