Infrared spectroscopy of chondrites and their components: a link between meteoritics and astronomy?

Conference or Workshop Item

INFRARED SPECTROSCOPY OF CHONDRITES AND THEIR COMPONENTS: A LINK BETWEEN METEORITICS AND ASTRONOMY?

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Introduction: Astronomical infrared spectra of a wide range of interstellar objects have become available in recent years, especially owing to space based telescopes like SPITZER. Among them are spectra of circumstellar discs of young stars, which represent the solar system in a early stage. To find out what these spectra can tell us about the mineralogical composition of these discs, infrared spectra of objects with known composition are needed. Studies in this area have been made by the analysis of synthetic analogs e.g.[1] and of IDP e.g.[2]. In a further step, we try to find a connection between meteoritics and astronomy by systematically obtaining infrared (IR) spectra from minerals and other components (like calcium-aluminium rich inclusions (CAI) and chondrules) of primitive meteorites. We assume that these materials are very useful for this purpose, since they have formed in environments probably more similar to the origin of the astronomical spectra than terrestrial analogues.

Techniques: We applied a whole range of IR techniques on material from chondrules and CAI, using a Perkin Elmer AutoImage IR microscope and a SpectrumOne workbench. This was necessary owing to the often extremely fine grained nature of these materials, which made a separation of single, homogeneous mineral grains often impossible. *In-situ* measurements were conducted using the microscope in the specular reflectance mode, which allows to obtain spectra from areas down to 10 10 m. From these reflectance spectra, the absorption component could be calculated using the Kramers-Kronig algorithm. When small amounts of material could be separated from the specimen, the sample was powdered and analysed in the transmission/absorption mode of the microscope. The wavelength range covered by these techniques was 2.5 to 16 m. When larger amounts of substance can be provided (e.g. bulk chondrules), we will use workbench techniques like diffuse reflectance mode. This techniques allows a larger wavelengths range from 2.5 to 50 m. The chondrule analysed was on a polished block of an Allende sample (Fig.1a). For preliminary characterization, the phases were characterized by their stochiomentry using SEM-EDX.

Results: As an example, we present in Fig.1b the results of *in-situ* measurements of a chondrule in the CV3.2 chondrite Allende, compared with a infrared spectra [3] of the circumstellar discs from the T-Tauri star TW Hya and Pictoris [4] (Fig.1c).

References: [1] Fabian D. et al. (2001) *A&A, 373,* 1125-1138. [2] Molster F. J. and Bradley J. P. (2001) *Lunar Plan. Sci., XXXII,* A1391. [3] Sitko M. L. et al. (2000) *Astron. Journ., 120,* 2609-2614 [4] Knacke et al. (1993) *Astrophys. J., 418,* 440-450.

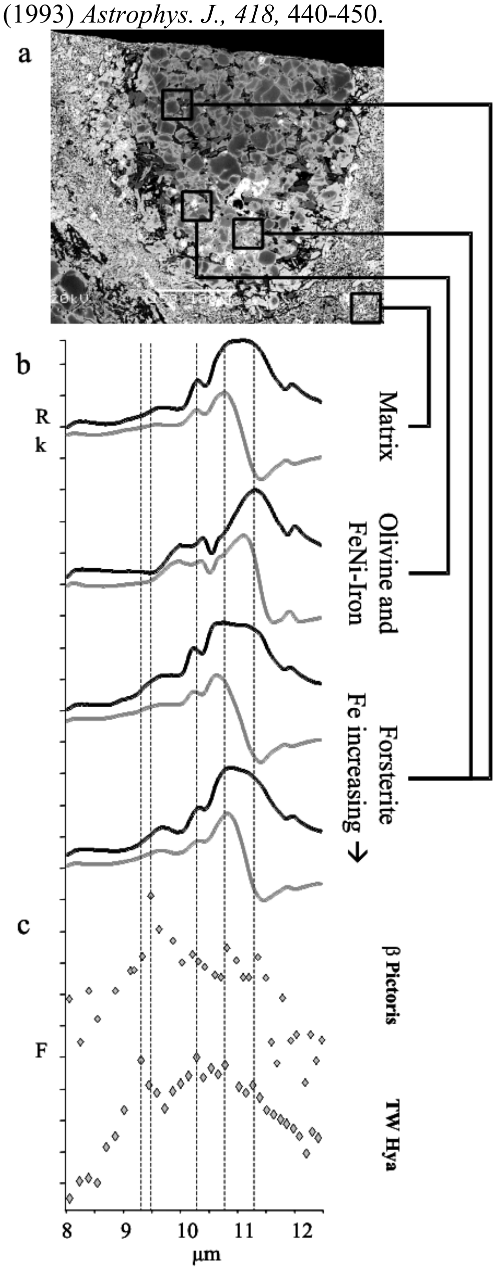

Fig.1a-c. (a) BSE image of a chondrule in Allende, (b) reflectance (R) and calculated absorbance infrared spectra (k) from various parts, (c) astronomical spectra.