Mid-infrared spectroscopy of CAI and their mineral components

Conference or Workshop Item

MID-INFRARED SPECTROSCOPY OF CAI AND THEIR MINERAL COMPONENTS. A. Morlok[1,4]; M. Koehler[2,4]; O.N.Menzies[3,4]; M. M. Grady[1,4] [1]Department of Mineralogy, The Natural History Museum, Cromwell Road, London SW7 5BD, e-mail A.Morlok@nhm.ac.uk [2]Institut fuer Planetologie, Wilhelm-Klemm-Str.10, 48149 Muenster, Germany [3]Imperial College London, South Kensington Campus, SW7 2AZ [4]IARC

Introduction: Calcium-aluminium rich inclusions (CAI) represent highly refractory materials formed very early in the history of our solar system. As such, infrared spectra taken from their components and minerals are of interest for the search of mineral phases in astronomical spectra of circumstellar discs of young stars. Although not completely pristine, these mineral phases formed possibly in environments similar to those found where the astronomical spectra come from.

So far, for comparison purposes mainly terrestrial analogs like synthetic minerals e.g.[1] or whole dust particles like IDP [2] have been used.

Techniques: Owing to the fine grained nature of the minerals and components, which made a separation of single, homogeneous mineral grains mostly impossible, a whole range of different FT-IR techniques was applied. For *in-situ* measurements we used a Perkin Elmer SpectrumOne FT-IR microscope in the specular reflectance mode, which allows to obtain spectra from areas down to 10 10 m. From these reflectance spectra, the absorption part was obtained using the Kramers-Kroning algorithm. When it is possible to separate material from a CAI, we plan to analyse powdered samples in the transmission/absorption mode of the microscope. The wavelength range covered by these techniques is 2.5 to 16 m.

The CAI analyzed was on a polished block of a Ornans CO3.3 sample. Phases were preliminary characterized based on their stochiometry using SEM-EDX.

Results: The compact CAI (Fig.1a) mainly consists of spinel and melilite, surrounded by Al-diopside. Fig.1b shows the reflectance (R) and calculated absorbance spectra (k) of areas in the CAI.

Discussion: Fig.1c compares the results with infrared spectra of the circumstellar discs from the T-Tauri star TW Hya [3] and Pictoris [4] (Fig.1c). While there is no perfect fit, the band positions in the absorbance spectra e.g. of the melilite/spinel mixture and the Al-diopside exhibits some similarity with the TW Hya spectra for two bands.

References: [1] Hofmeister A. M. et al. (2003) *Mon. Not. R. Astron. Soc. 345,* 16-38. [2] Molster F. J. et al. (2003) *Lunar Plan. Sci. XXXIV,* A1148. [3] Sitko M. L. et al. (2000) *Astron. Journ., 120,* 2609-2614 [4] Knacke et al. (1993) *Astrophys. J., 418,* 440-450.

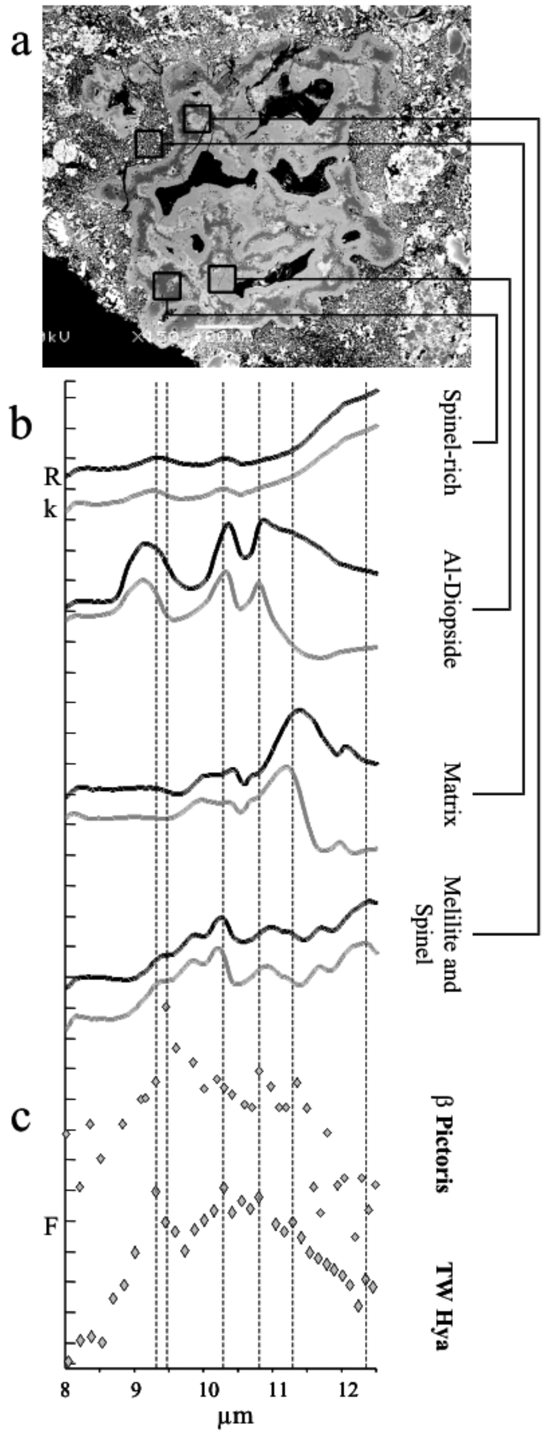

Fig.1a-c. (a) BSE image, (b) reflectance (R) and absorbance (k) IR *in-situ* spectra, (c) astronomical data.