OPTICAL PROPERTIES OF LIKELY CONSTITUENTS OF INTERSTELLAR DUST

A thesis presented by

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DECLARATION AND CERTIFICATE

The work submitted in this thesis has been carried out by the candidate, except where due acknowledgment is given.

I hereby certify that this work has not already been accepted in substance for any degree and is not being concurrently submitted in candidature for any other degree.

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(Supervisor)

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I.J.D.

SUMMARY

Optical properties of polyoxymethelene (POM) at room temperature have been measured from the near ultra-violet to infra-red as an initial stage of a link between interstellar dust and organic matter, and we report our results which are particularly relevant to interstellar extinction. There is a strong possibility of a more complex organic component which could significantly contribute to the interstellar extinction.

Measurements have also been made of the effect of fast neutron bombardment on the optical properties of quartz (SiO_2). At a high total flux of neutrons the crystalline quartz will change to its amorphous form which has extinction properties that resemble the interstellar extinction. Extinction due to small particles of several forms of SiO_2 have been measured and among them the hydrated mineral, opal, behaved like an amorphous silica.

Neutron irradiated olivine showed a stronger and a broader 10μm band in addition to weaker bands towards the longer wavelengths which indicated that atomic damage has been produced. At high fluxes more atomic damage is expected to change the crystalline structure and thereby cause changes in the infra-red absorption properties.

Extinction measurements were also made for smoke particles of MgO in the infra-red. When the measurements were made with the particles deposited on substrates, in addition to a very broad surface mode absorption feature around 20μm an extinction maximum was observed typical of the bulk mode at 25μm. Extinction measurements for MgO smoke particles in air also showed similar results. However when the particles were dispersed in a non-absorbing medium, the bulk absorption mode was not observed. This implies that the appearance of the bulk mode is due to clumping. It was also observed that the width of the band reduced significantly with decreasing powder density f in the medium. Hence it is concluded that considerable broadening is due to interactions which is not properly accounted for in the single particle theory.

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