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VOLATILES IN INTERPLANETARY DUST PARTICLES AND AEROGELS

E. K. Gibson, Jr.* and C. P. Harnetz
SN2 Planetary Sciences, NASA Johnson Space Center

Interplanetary dust particles (IDPs) offer a unique opportunity for developing a better understanding of the cosmic history of the organogenic elements. The study of IDPs has shown that they are complex, heterogeneous assemblages of both high and low temperature phases and minor amounts of amorphous components. Some components in IDPs may have originated as stellar or nebular condensates, interstellar dust, interstellar or nebular molecules and products of parent body processes (e.g. on comets or asteroids). The degree of success in distinguishing between these possible sources rests largely with the ability to carry out compositional analysis for elemental, isotopic, molecular, and mineralogical characterization. We have been studying the nature of volatiles associated with IDPs by analyzing the materials associated with the collection of IDPs (i.e. silicone oil, etc.) along with analyzing individual IDPs which have been "cleaned of their contaminants." A laser microprobe-mass spectrometer (LMMS) technique is utilized to vaporize the volatiles within an individual IDP and detect the components associated with the particle.

Volatiles measured in 25 IDPs are a mixture of both indigenous materials and contaminants associated with the collection and processing of the IDPs prior to analysis. Most IDPs have been collected in the stratosphere using a silicone oil/ freon mixture (20:1 ratio) coated on collector plates. Studies have shown that silicone oil, freon and hexane residues remain with the IDPs, despite attempts to clean the IDPs. Analysis of the IDPs with the LMMS-technique produces spectra with a mixture of indigenous and contaminants components. Contamination signal can be identified and removed, however the contamination signal may obscure some of the indigenous component's signal. Employing spectra stripping techniques, the indigenous volatile constituents associated with the IDPs can be identified. Volatiles are similar to those measured in CI or CM carbonaceous chondrites. Collection of IDPs in low-Earth orbit utilizing a Cosmic Dust Collection Facility attached to Space Station Freedom has been proposed. The low-density material aerogel has been proposed as a collection substrate for IDPs. Our studies have concentrated on identifying volatile contaminants that are associated with aerogel. We have found that solvents used for the preparation of aerogel remain in aerogel and methods must be developed for removing the entrapped solvents before aerogels can be used for an IDP collection substrate.