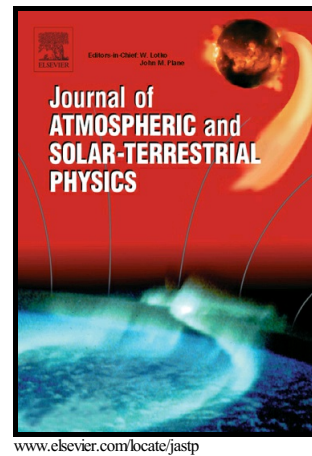


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Synthesis and Characterisation of Analogues for Interplanetary Dust and Meteoric Smoke Particles

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Abstract

Analogues have been developed and characterised for both interplanetary dust and meteoric smoke particles. These include amorphous materials with elemental compositions similar to the olivine mineral solid solution series, a variety of iron oxides, undifferentiated meteorites (chondrites) and minerals which can be considered good terrestrial proxies to some phases present in meteorites. The products have been subjected to a suite of analytical techniques to demonstrate their suitability as analogues for the target materials.

Keywords: Interplanetary Dust; Meteoric Smoke; Micrometeorites; Sol-gel synthesis

1. Introduction

Many processes in atmospheric environments are controlled by the availability of reactive or catalytic surfaces which originate from outside that atmosphere (Nachbar, et al., 2016, Petrie, 2004, Plane, 2012, Turco, et al., 1981). However, this extraterrestrial material is only partially characterised and understood in terms of these various atmospheric processes. Meanwhile, collecting the relatively large quantities required for surface science experiments (often grams to kilograms) from the atmosphere presents an extremely large engineering challenge (Hedin, et al., 2014). In order to investigate and understand such atmospheric processes, it is therefore vital to employ suitable analogue materials which will mimic the behaviour of the environmental material.

The majority of dust which enters planetary atmospheres in our solar system originates from either Jupiter Family Comets (JFCs), the Asteroid Belt (AB), Halley Type Comets (HTCs) or Oort Cloud Comets (OCCs) (Nesvorný, et al., 2011, Nesvorný, et al., 2010). To determine the appropriate material to mimic the atmospheric behaviour of Interplanetary Dust Particles (IDPs), the nature of such dust before encountering an atmosphere and the processes it will undergo during atmospheric entry must be considered.

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