

ATMOSPHERIC ENTRY OF CARBONATE MICROMETEOROIDS G. Micca Longo¹ and S. Longo², ¹Dipartimento di Chimica, Università degli studi di Bari Aldo Moro, Via Orabona 4, I-70126 Bari (Italy) (gaia.micca-longo@uniba.it), ²Dipartimento di Chimica, Università degli studi di Bari Aldo Moro, Via Orabona 4, I-70126 Bari (Italy) & CNR-Nanotec Bari Section, Via Amendola 122/D, I-70126 Bari (Italy) (savino.longo@nanotec.cnr.it).

Introduction: Micrometeoroids have similarities in chemistry and mineralogy to the CI, CM and CR chondrites [1], suggesting that they are very primitive materials in the Solar System. But most micrometeoroids experience atmospheric entry heating that changes primary mineralogy. Actually, [2] reported the discovery of eight micrometeorites containing chondritic igneous objects, which indicates that at least a portion of coarse-grained crystalline micrometeorites represent chondrule fragments. This suggests that the parent bodies of micrometeorites resemble the parent asteroids of chondrulebearing carbonaceous chondrites. Relative volatile components present in these samples are specially interesting in the discussion of origin and diffusion of life and complex organic chemistry in the Solar systems. Among these, inorganic carbonates play a very important role when meteor matter is considered in an astrochemical context [3–7]: the knowledge of their physical and compositional properties and of their survival during atmospheric entry may provide information about the presence of organic matter in their parent bodies (comets, asteroids, interplanetary dust). Indeed, carbonates are often associated with the presence of organic matter [8–10], so, in this perspective, they could be one of the keys to understand the complex chemistry of the Solar System [11]. (Mg,Fe)CO₃ (the carbonate analogue of the Forsterite-Fayalite series) is common among phyllosilicate-rich micrometeorites and CI chondrites and has been reported as well in micrometeorites [12]. Carbonates of II group elements (in particular aragonite and calcite) have been detected spectroscopically in cometary grain in close association to complex organic molecules [13]. In [14], the facile decomposition of magnesium carbonate has been advocated as a possible cooling mechanism during delivery scenarios of organic matter to primordial Earth.

In spite of this state of the art, there has been little attention to the thermal properties of carbonate minerals in the context of meteoritic studies, in particular to assess their behavior when grains rich in carbonates enter Earth's atmosphere. It is true that the thermal decomposition of carbonates is poorly characterized from a kinetic point of view [15–17]. While this difficulty is hardly overemphasized, times are mature to start a rigorous theoretical study of the behavior of pure and mixed carbonates in atmospheric entry scenarios, in

order to gather the essential information on which future evaluations will be grounded.

A preliminary work for a specific material (pure magnesite), based on a rigorous dynamic and thermal model of the grain entry, is presented and a first-attempt model of the decomposition kinetics is proposed. Pure magnesite (MgCO₃) is proposed as a mineral model. A dynamic-kinetic model has been developed, very close to that reported on [18] although improved in some minor details, and used as a standard description of the entry process in order to evaluate the effects to carbonate evaporation kinetics.

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