BRAKING OF METEOR PARTICLES IN THE ATMOSPHERE OF THE EARTH AND CREATION OF MAGNETIC MICROSPHERES

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Introduction: Sedimentary rocks of the Earth contain metal spherical particles from the first to several hundreds of micrometers in diameter [1]. They are composed of native iron, wustite, magnetite and they are magnetic. Their cosmic origin, ubiquity of distribution, easy extraction by a magnet predetermines the possibility of using such objects for the purposes of global stratigraphic correlation of sedimentary strata. For this, it is necessary to identify typomorphic genetic features of magnetic microspheres.

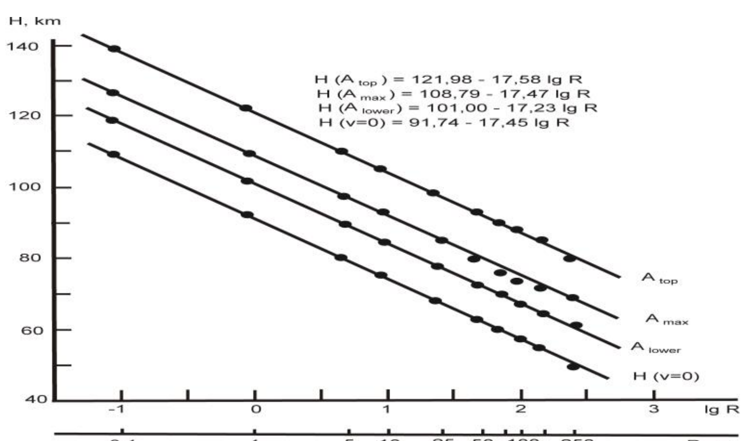
Methods: Calculations of the atmospheric braking (with a step of 2 km in height) of meteoric particles of native iron of spherical shape for different radiuses - from 0.1 μm to 250 μm have been made. In the calculations was used the braking equation [2]: $M\,(-dv/dt) = \Gamma \cdot S \cdot \rho_a \cdot v^2$, where M is the mass of a meteoroid body; (-dv/dt) is the amount of braking; Γ is the fraction of the energy which is going to the warming up of the meteoroid body; S is the cross-sectional area of the meteoroid body; ρ_a is the density of the atmosphere; v is the velocity of the meteoroid body. The following parameters were used in the calculations: Γ = 0.05, the initial velocity of incidence of particles is 15 km/s, the trajectory of incidence with an angle of 48.2 ° to the vertical of the Earth's surface. At each step, the value of the specific energy of inhibition was calculated. At the last step, the total braking height H (v = 0) was calculated, where the velocity along the flight path decreased to zero. For the melting point taken the specific heat of fusion for iron - 247 J/g [3].

Results: For particles of each size, the dependence of the magnitude of the braking energy on the altitude above the Earth was found. With decreasing altitude this energy increased and crossed the melting point A (Γ =0.05)·4940 J/g at the height H (A_{top}), reached its maximum at the height H (A_{max}), and then decreased again, crossing the same melting point at altitude H (A_{lower}). For the particles of all the studied sizes, the altitude positions of the levels A_{top}, A_{max}, A_{lower}, as well as the heights of their total deceleration H (v = 0) are determined, along which the graphs are plotted (Figure) and the correlation equations corresponding to them are calculated.

Discussions: Calculations have shown that meteoric particles of native iron 0.1-250 μm in size melt (without taking into account the energy lost by radiation) during their braking in the Earth's atmosphere. Allowance for energy loss by radiation, performed by the method described in [4], shows that the value of the critical radius for our conditions is 7μm, i.e. particles with a radius less than 7μm do not melt, and more than this value they are melted. All this predetermines the possibility of the formation of spherical (spherical) shapes from their melt, which is also facilitated by the appearance of a torque in the melt particles, which increases as the flight speed approaches zero.

Conclusions: Due to the melting and rotation of the melt particles at the end of the stopping path, the melt drops elongated in the direction of flight are shortened and then become spherical in shape. At the same time, they cool and crystallize to form magnetic microspheres.

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.



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