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Material Identification of single particle using magnetic volume force

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The efficiency to observe translation and rotation of a sub-millimeter sized sample induced at low field intensity has increased by improving an apparatus that is operated in a short micro-G condition. From the period of rotational oscillation induced in a homogeneous field of 0.2T, paramagnetic anisotropy was newly detected on a sub-millimeter sized crystal, namely for hydroxyl-apatite. From velocity of a diamagnetic grain that is ejected in the direction of monotonously decreasing field (Bmax=0.5T), diamagnetic susceptibility is detected for a single grain. From the compiled experimental data, mass independent property of translation was confirmed on a metal material, namely bismuth. The obtained techniques to observe field-induced motions of sub-millimeter sized samples is a step forward to detect susceptibility and its ansiotropy of a weak magnetic particle at micron- and nm level, which is expected to provide information on the relationship between lattice deformation and size reduction.

Field-induced rotation and translation was commonly observed in a diffuse micro-g condition for a single a sized diamagnetic particle by applying a static magnetic field below 1T, The motions are independent to mass of grain because they are induced by magnetic volume forces which derive from individual atoms composing grains. Field-induced motions of ordinary solid, free of spontaneous moment, has not been recognized previously at such low field. By using the above-mentioned apparatus, the reproduction of various elemental (rotational and translational) processes of dust particles that are expected in space and planetary science becomes possible in an ordinary laboratory. The result of above-mentioned field-induced translation is applicable in identifying the micron-sized grains or regolith collected at the surface of asteroids, planets and satellites. The observations are desired as well on the elemental processes assumed in other models on dust alignment. The motions were observable by introducing a short drop-shaft (micro-g duration $>$ 0.5 s), which was realized by adopting a pair of small Nd-Fe-B plates(3 x1x0.5cm)as a field generator. The present technique established for sub-mm sized crystal is a step to detect the movement of micron-sized grains.

[1]C.Uyeda et al(2010)J. Phys. Soc. Jpn,79, 064709.
[2]K Hisayoshi et al(2011)J. Phys.: Conf. Ser. 327 012058

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