Attempt to separate various diamagnetic and paramagnetic materials using a neodymium handy magnet

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A strong magnetic field above several Tesla is generally required to induce a dynamic motion in a diamagnetic or paramagnetic substance. We recently showed that a grain mixture that consist of heterogeneous materials can be separated into groups of different materials by releasing the mixture in an area where field distribution monotonically decreases[1]; the field was produced by a compact NdFeB magnet (see [2] for movie). The translation of the grains were realized in the diffused area (<100Pa) by introducing microgravity condition. The separation of grains was realized because magnetic force induced in the particle was proportional to mass m of particle, and its acceleration was independent to m [1]. By improving the present apparatus, most solid materials can be separated and identified by their susceptibility obtained from terminal velocity[2]. It is important to develop an simple and effective method to extract minor particles from heterogeneous grain samples, and the proposed principle may lead to new finding in material science.

References:

[1] K. Hisayoshi, C.Uyeda, K. Terada (2016) Sci. Rep. 6, 38431
[2] https://www.youtube.com/watch?v=SBUmSsNKM5c