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Electrostatic charging of powder in a metal shaker

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To examine characteristics of tribo-electrificatoin of powder particles, a certain number of particles, of 100 μm range in diameter, were loaded in a metal capsule and shaken. After shake for a while, total amount of charge on the entire particles were measured with Faraday-cage. The used capsules were cubic and made of metal, with 10-30 mm size on a side. Sample particles were spherical, made of zirconia, alumina and glass of 100 μm, 200 μm and 300 μm in diameter. With more than one minutes shake, it was confirmed the amount of electrostatic charge reached a saturation. The amount of the saturated charge per particle (average charge on a single particle) was reduced with an increase of the number of particles in a shaker. The results were qualitatively compatible to the case of Akashi et al. [1], where similar experiments were performed with 2-4 mm spherical particles made of polymer. In their discussion, it was supposed that the reduction of the amount of charge with an increase of number of particles was due to space charge effect, where a charge transfer on a particle is affected by external electric field generated by the other charged particles. The amount of the saturated charge per particle was a function of particle size, number of particles and capsule size. Akashi et al. showed that the space charge effect can be expressed by a single parameter of volume ratio of particles in a capsule, and they proposed an empirical formula to estimate the amount of the saturated charge per particle. Our data in this work with inorganic particles of 100 μm range was also unified on an Akashi's master curve, however, a factor to fit the curve on the entire data was significantly smaller than that of polymer particles by Akashi et al. The reason is not known yet. But the results showed shat the generation of charge was significantly smaller by the difference of material or particle size range, nevertheless, the space charge effect takes place with the same mechanism, and which can be expressed by a single parameter of the particle volume ratio.

T.Akashi, M.Imba, et al. "Evaluation of Electrostatic Charging of Particles in a Metal Shaker" Journal of the Society of Powder Technology, Japan, 50, pp.845-850, 2013