

Using acoustic levitation to study tribocharging of sub-millimeter particles

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Abstract — Fundamental research on tribocharging of particles is complex because this effect is usually measurable only after a large number of particle-particle and particle-wall collisions, making it difficult to interpret what happens during a single contact event. Here we present a new method that allows us to measure the change of net charge on individual sub-millimeter particles with high precision. We do that by acoustically suspending the particle in air and tracking its motion in response to applied ac and dc electric fields with a high-speed camera. We investigate tribocharging of the particle by temporarily switching off the levitation, thereby creating a controlled sequence of collisions with a target surface. We find that when a 200- μm diameter polyethylene particle collides with an aluminum surface at a velocity of ~ 0.1 m/s, the particle obtains several hundreds of negative elementary charges during a single collision. This technique opens up new possibilities to study the charge transfer process during a single contact for tribocharging of granular materials.