A fragmentation model approach for low velocity impact charging

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This work addresses the generation of charge during impacts of nano- to microscale projectiles on metal surfaces at speeds from 0.1 to 10 km/s. These speeds are well above the range of elastic deformation and well below speeds where volume ionization occurs. Earlier models have utilized impurity diffusion through molten grains together with a Saha-equation to model impact ionization at these speeds. In this work we employ a model of capacitive contact charging in which we allow for projectile fragmentation upon impact. We show that this model well describes laboratory measurements of metal projectiles impacting metal targets. It also can describe in-situ measurements of dust in the Earth's atmosphere made from rockets. We also address limitations of the currently most used model for impact ionization.