Proceedings of STEP-V
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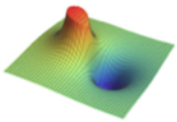

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STEP-V#3

Discrete Element Method modelling of triboelectrification of powders during aerodynamic dispersion

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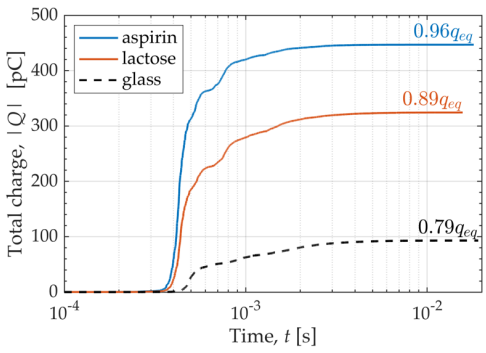
Several solids processes driven by air flow are affected, in most cases adversely, by tribolectrification, such as fluid bed reactors for polyolefins and pharmaceutical powder inhalation devices. The current understanding and characterization capabilities are not sufficient to ensure widespread prevention of the impact that electric charge accumulation can have on the performance and safety of industrial units. To improve the understanding and availability of relevant data, innovative characterization tools and advanced modelling methods are being explored to link the governing microscopic phenomena with the observed macroscopic effects. In the present contribution, the implementation of charge transfer and accumulation between contacting particles within the Discrete Element Method is illustrated in the context of simulation of the gas-solid flow in an aero-dispersion device. Elements of the modelling strategy with advantages and limitations are discussed. Results of DEM-CFD modelling of coupled hydrodynamics/tribocharging are presented for spherical particles (glass ballotini), representing ideal shape for modelling and pharmaceutical powders (α-lactose monohydrate and aspirin crystals), including detailed collision statistics. The analysis shows that charging of assemblages of particles can be predicted based on single particle impact charge transfer and that particle-wall charge transfer is the dominant mechanism. Pharmaceutical particles charge significantly more than glass ballotini. For each test material, the charge-to-surface area ratio turns out to be remarkably constant and close to its equilibrium value.



Evolution of total charge acquired by 1 mm^3 samples of α-LM, aspirin and glass ballotini until all particles have left the system.