Evaluation of a New Dispersion Technique for Measuring Triboelectric Charging of Particles

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In powder handling operations, triboelectric charging can readily occur, causing problems like segregation, agglomeration, deposition or adhesion. Moreover, if particles are excessively charged, an electrostatic discharge may occur, which can result in fire or dust explosion. For dielectric solids it is difficult to predict triboelectric charging propensity and it has to be measured, as the charge transfer mechanisms are not well understood. In a number of applications, such as pharmaceutical powders, there is often a very small powder quantity available for testing for new drugs and so it is highly desirable to be able to quickly evaluate it, and where possible using the smallest powder quantity possible.

In the present work, a powder dispersion device (the disperser of Malvern© Morphologi G3) is adopted to cause triboelectric charging of powders. A very small powder quantity (as small as 0.1 mg) is dispersed by a pressure pulse of compressed gas such as air or nitrogen. The high transient gas velocity causes collisions of the particles with the containing walls resulting in dispersion, but also causing tribo-electric charging of the particles. In this presentation we evaluate the charging propensity of a number of materials and analyse the effect of surface functional groups on the tribo-electric charge transfer. A number of organic crystalline particles (aspirin, paracetamol, α-lactose monohydrate) and model materials with a well-defined shape (glass beads) but with different silane groups deposited on their surfaces are tested. The process is also analysed by the Computational Fluid Dynamics (CFD), by which the influence of air flow on particle trajectories and impact velocities is predicted. The charge transfer to particles is predicted as a function of impact velocity and number of collisions based on a charge transfer model established previously for several model particle materials.

Keywords: Triboelectric charging, Malvern Dispersion unit, Pharmaceutical powders, Surface properties

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