Collision dynamics of colliding wet solids : rebound and rotation analysis

COLLISION DYNAMICS OF COLLIDING WET SOLIDS: REBOUND AND ROTATION ANALYSIS

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Fluidization processes are characterized by intense particle-particle and particle-wall contacts. In coating, granulation and agglomeration processes moreover liquids are involved in the form of liquid layers or droplets on the particle surface. Therefore, the knowledge about collision dynamics of wet solids is fundamental for the exact description of such processes.

In this work collision dynamics are analyzed via coefficients of restitution. The coefficient of restitution is defined as ratio of rebound to impact velocity and as such it characterizes the energy dissipated during collision. It is an important parameter for DEM simulations and depends strongly on the collision parameters (such as collision velocity, angle), particle properties (size, deformation behavior) as well as on the properties of the injected liquid (viscosity, layer thickness). To investigate the influence of these parameters on the effective coefficient of restitution, particles normally and obliquely colliding with a wet wall are recorded by two synchronized high-speed cameras allowing a three-dimensional analysis of collision behavior.

The coefficient of restitution in normal direction is independent of the collision angle, but strongly dependent on particle size, impact velocity and the liquid properties. The tangential coefficient of restitution however shows a minimum in dependence of the collision angle. Surface roughness shows an additional influence on the dry as well as wet collision behavior. Besides energy dissipation in translational direction also particle rotation and the influence of initial rotation on rebound behavior are analyzed.

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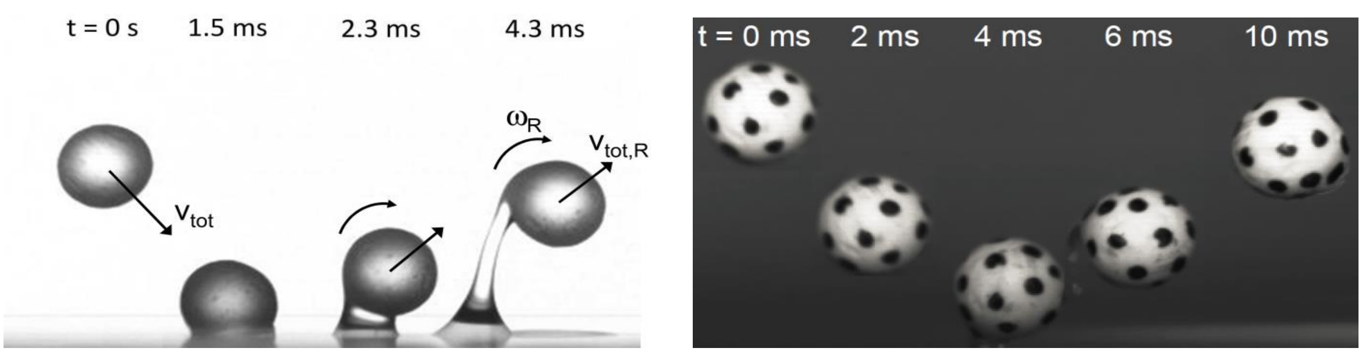

Figure 1: Comparison of collision dynamics of glass particles (left) and aluminum oxide particles (right) impacting on a glass plate covered by a liquid layer of 400 µm and 100 µm layer thickness, respectively.