# Restitution coefficient for single particles obliquely impacting on wet surfaces

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# RESTITUTION COEFFICIENT FOR SINGLE PARTICLES OBLIQUELY IMPACTING ON WET SURFACES

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**Presenting author:** Britta Crüger
**Authors and affiliations :** Britta Crüger:Institute of Solids Process Engineering and Particle Technology,Hamburg University of Technology,Hamburg,Germany|Stefan Heinrich:Institute of Solids Process Engineering and Particle Technology,Hamburg University of Technology,Hamburg,Germany|Sergiy Antonyuk:Particle Process Engineering, Department of Mechanical and Process Engineering,University of Kaiserslautern,Kaiserslautern,Germany|Niels G. Deen:Multiphase Reactors Group, Department of Chemical Engineering and Chemistry,Eindhoven University of Technology,Eindhoven,Netherlands|J. A.M. Kuipers:Multiphase Reactors Group, Department of Chemical Engineering and Chemistry,Eindhoven University of Technology,Eindhoven,Netherlands

**Abstract:**
Particulate processes are fundamental to a wide range of operations in the chemical, pharmaceutical and food industries and are strongly influenced by the dynamics of the particles’ motion. Therefore the knowledge about the micromechanics of particle interaction is vital for the description and simulation of particle systems. In many solids processes, such as granulation, agglomeration and drying, liquids are additionally involved as layers on the particles or as moisture inside the particle structure, changing the particle behavior dramatically.
Since a fundamental description of the dynamics of wet particle collisions is still missing, in this work the collision behavior of dry particles impacting obliquely on wet surfaces is investigated by means of the coefficient of restitution. The coefficient of restitution is defined as the ratio between the velocities after and before the impact and as such characterizes the energy dissipation during the collision. It is a significant parameter in DEM simulations and depends strongly on the particle behavior, such as elastic or plastic deformation, the collision parameters, e.g. collision velocity and angle, as well as the properties of the liquid, such as layer thickness and viscosity. To obtain the influence of these parameters on the wet collision behavior particle-wall impacts were investigated by means of two synchronized high-speed cameras allowing a three-dimensional analysis (Figure).
The normal component of the coefficient of restitution is approximately constant for impact angles between 0 and 60°, but the tangential coefficient of restitution shows a minimum at approximately 20° for water as liquid layer. An increase of the liquid viscosity shifts this minimum to smaller collision angles and leads to a decrease of the normal coefficient of restitution. The velocity and liquid layer thickness also feature a strong influence on the coefficient of restitution.

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**Reference 1:**
**Reference 2 :**
**Reference 3 :**
**Reference 4 :**

**Highlight 1:** Micromechanics of wet oblique collisions is investigated in three dimensions.
**Highlight 2:** Increase of layer thickness and viscosity decrease normal restitution coefficient.
**Highlight 3:** Change of liquid viscosity leads to shift of rolling-sliding contact transition regime.