Investigation of rebound behavior of wet solid materials

15 Partikeltechnik 21+

Ü15.01
Grundprinzipien der Produktgestaltung

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DOI: 10.1002/cite.201650509

Unit operations und Produktdesign sind die beiden wichtigsten Säulen der Verfahrenstechnik. Unter Produktdesign wird die Bildung, Formulierung und Charakterisierung von komplex zusammengesetzten Produkten verstanden. Die jeweiligen Anwendungen definieren dabei die geforderten Produkteigenschaften sowohl in den klassischen Feldern der chemischen Industrie als auch in neuen Feldern wie der druckbaren Elektronik, der Energie- und Umwelttechnik, den Lebenswissenschaften, der pharmazeutischen Technologie und der Nanotechnologie.

Im Beitrag werden Grundprinzipien des Produktdesigns vorgeschlagen, die auf eine Vielzahl von Produkten einschließlich fester, flüssiger oder gasförmiger Partikelsysteme anwendbar sind. Ergebnisse aus dem Erlanger Exzellenzcluster „Engineering of Advanced Materials“ zeigen, dass die enge Zusammenarbeit zwischen Verfahrenstechnik, Materialwissenschaft und den Naturwissenschaften fruchtbare neue Optionen für die beteiligten Fachbereiche eröffnet. Rigorose mathematische Optimierung auf der Basis prädiktiver Modelle für Produkte und Prozesse katalysieren dabei neue Möglichkeiten zum Design partikelbasierter Produkte in Zukunftsbereichen wie etwa der Elektronik, Photonik oder dem 3D-Druck [1].

[1] W. Peukert et al., in *Mesoscale Modeling in Chemical Engineering Part I, Advances in Chemical Engineering* (Eds: J. Li, G. B. Marin), Vol. 46, Academic Press, New York **2015**, 1 – 81.

V15.01
Use of Spouted-Bed Spray Granulation Process for Fabrication of Metal/Ceramic-Polymer Composites

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DOI: 10.1002/cite.201650042

Naturally occurring structural materials are hard-soft phase composites with several hierarchical levels and very high filling degrees on hard constituents. High filling degrees are necessary to achieve a high hardness and stiffness of the structural biocomposites. A process for the fabrication of very highly filled composite materials by using the spouted-bed spray granulation process is presented.

The spouted-bed spray granulation process is very versatile in application and can offer many advantages for the design of composite materials. Fine particles are spouted and optimal properties for further processing to bulk materials could be obtained by means of granulation. With a specially designed apparatus it was possible to treat fine particles applying a dilute spouting regime and to granulate particles without elutriation. After granulation, particles were assembled to composite materials. Mechanical properties of these were analyzed by means of experiments and discrete element method in four-point bending tests.

We gratefully acknowledge financial support from the German Research Foundation (DFG) via the collaborative research center SFB986.

V15.02
Investigation of Rebound Behavior of Wet Solid Materials

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DOI: 10.1002/cite.201650065

Knowledge about collision dynamics is fundamental to understand particulate processes, which are characterized by intense solids contact. Often liquids are additionally involved as droplets or layers on the particle, strongly changing collision behavior.

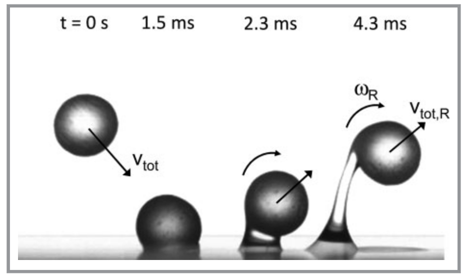

Figure. Exemplary particle movement and liquid bridge formation during oblique collision of a dry glass particle with a glass target plate covered by a water layer of 400 µm thickness.

Therefore, in this work, collision dynamics and especially rebound behavior are investigated. Particles colliding with a wet target are captured by two synchronized high-speed cameras allowing a 3D analysis. Using the coefficient of restitution, an important parameter for DEM simulations defined as ratio of rebound to impact velocity, energy dissipation during the collision can be analyzed in dependence of particle, liquid, and collision properties. During oblique collisions, the coefficient of restitution in normal direction is independent of the collision angle, but dependent on collision velocity and the properties of liquid and particle. On the contrary, the coefficient of restitution in tangential direction is depending on the collision angle, but only slightly on the liquid properties.

We gratefully acknowledge for financial support: DFG, Germany and STW, The Netherlands. Project number HE 4526/9-2.

V15.03

High-Efficient Gas Phase Dispersion of Nanoparticle Agglomerates during Oblique Wall Collisions Compared to Hydrodynamic Stresses

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DOI: 10.1002/cite.201650362

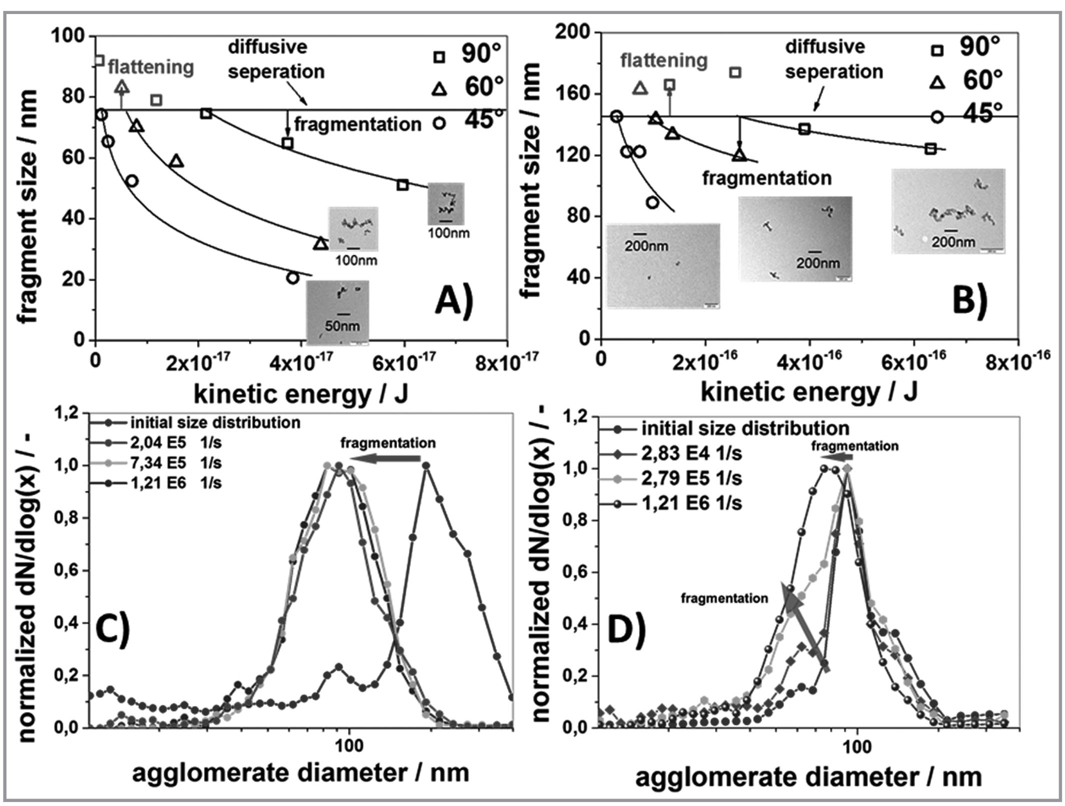

Figure. Agglomerate/fragment size as a function of the impaction energy for different impaction angles for platinum primary particles (A) and silicium dioxide primary particles (B); agglomerate size distribution of platinum agglomerates in different turbulent flows (indicated by the shear rate) with initial sizes of 220 nm (C) and 100 nm (D).

