

An experimental study of droplet-particle collisions

Citation for published version (APA):

Pawar, S. K., Henrikson, F., Finotello, G., Padding, J. T., Deen, N. G., Jongsma, A., Innings, F., & Kuipers, J. A. M. (2015). An experimental study of droplet-particle collisions. In *7th International Granulation Workshop, 1-3 July, 2015, Sheffield, UK*

Document status and date:

Published: 01/01/2015

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

130. AN EXPERIMENTAL STUDY OF DROPLET-PARTICLE COLLISIONS

Sandip K. Pawar¹, Filip Henrikson¹, Giulia Finotello¹, Johan T. Padding¹, Niels G. Deen¹, Alfred Jongsma², Fredrik Innings² & J.A.M. Kuipers¹

¹ Multiphase Reactors Group, Dept. Chemical Engineering and Chemistry, Eindhoven, NL

² Tetra Pak CPS, Heerenveen, NL

E-mail: g.finotello@tue.nl

When spray drying a liquid slurry such as milk, collisions between droplets, partially dried particles and completely dry particles are important because coalescence, agglomeration and breakup events influence the size and morphology of the produced powder. When modelling such a spray drying process, it is therefore important to be able to predict the outcomes of individual binary collisions. Both binary dry particle collisions and binary droplet collisions have individually been thoroughly researched over the years due to their widespread occurrence. The importance of understanding binary particle-droplet collisions has been emphasized more recently, but available studies are limited. To produce and record particle-droplet collisions, an experimental setup that enables synchronized release of both a particle and a droplet was used. One single hanging droplet was released from above onto a particle that initially was held in place by vacuum suction. A high speed camera was synchronised with the setup, and recorded the collisions. Image files were then analysed in Matlab to find velocities and sizes of the particle and droplet before and after impact. The contrast of particle and droplet against the illuminated background was a key factor in succeeding with this. Different collision outcomes were identified as either agglomeration (merging), where the whole droplet would stick to the surface of the particle, or a stretching separation (breaking), where the droplet collides with the particle in an oblique position and stretches out until a part of the droplet detaches from the liquid sticking to the particle. The formation of satellite droplets, i.e. droplets with a radius significantly smaller than the leaving droplet was also detected. The relation of these collision outcomes to impact conditions such as Weber number and impact parameter was reviewed and put into regime maps.