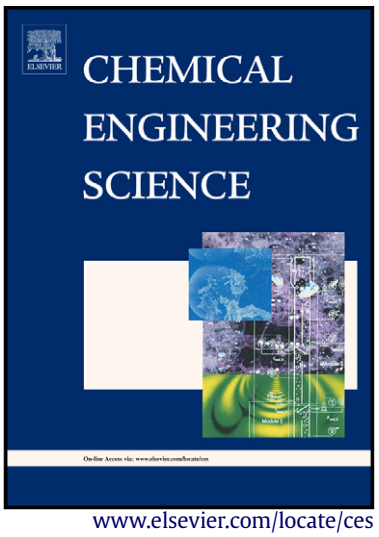

www.elsevier.com/locate/ces

Numerical Modelling of Breakage and Adhesion of Loose Fine-Particle Agglomerates

Duy Nguyen, Anders Rasmuson, Kyrre Thalberg, Ingela Niklasson Bjorn

PII: S0009-2509(14)00192-4
DOI: http://dx.doi.org/10.1016/j.ces.2014.04.034
Reference: CES11616

To appear in: *Chemical Engineering Science*

Received date: 18 December 2013
Revised date: 26 March 2014
Accepted date: 27 April 2014

Cite this article as: Duy Nguyen, Anders Rasmuson, Kyrre Thalberg, Ingela Niklasson Bjorn, Numerical Modelling of Breakage and Adhesion of Loose Fine-Particle Agglomerates, *Chemical Engineering Science,* http://dx.doi.org/10.1016/j.ces.2014.04.034

NUMERICAL MODELLING OF BREAKAGE AND ADHESION OF LOOSE FINE-PARTICLE AGGLOMERATES

Duy Nguyen[1], Anders Rasmuson[1], Kyrre Thalberg[2], Ingela Niklasson Björn[2]

[1]Chemical and Biological Engineering

Chalmers University of Technology, Gothenburg, Sweden

[2]AstraZeneca R&D centre, Mölndal, Sweden

Email of corresponding author: rasmuson@chalmers.se

Abstract

In this study, Discrete Element Method (DEM) simulations are used to examine the breakage and capturing behaviour of loose fine-particle agglomerates on impact with a target particle. The model system is an aggregate composed of 5 μm fine particles and a 200 μm target particle. The cohesion between fine particles was modelled using the Johnson, Kendall and Roberts (JKR) theory. In contrast to the breakage of hard agglomerates which break in large fragments, as commonly investigated, loose agglomerates break in finer fragments. Impact velocity was found to be a significant parameter not only for the adhesion strength but also for the structure of the particles captured on the target. The capture ratio of the agglomerate as well as the thickness of the particle layer covering the target decreases with increasing impact velocity. High impact velocity results in finer fragments attached to the target with greater tensile strength due to the re-structuring mechanism that occurs during impact. Accordingly, impact velocity is one of the critical parameters governing the structure resulting after collision. However, the effect of material properties, e.g. surface energy, material hardness and plasticity, on adhesion behaviour should be investigated to obtain a full picture of the breakage-adhesion regime map.

Highlights

- The breakage of a loose agglomerate on impact with a carrier particle was simulated
- The adhesion of breakage fragments on the carrier surface was analysed
- New interparticle bonds are created during breakage
- Impact velocity significantly affects the structure of adhered fine particles
-

Keywords:

loose agglomerates; breakage; adhesion; discrete element method