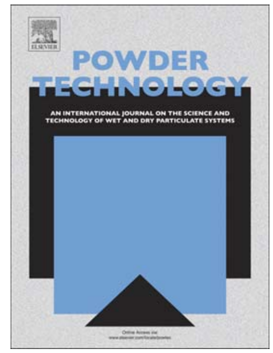
Accepted Manuscript



Study of the morphology of solidified binder in spray fluidized bed agglomerates by X-ray tomography

M. Dadkhah, E. Tsotsas

PII: S0032-5910(14)00492-6
DOI: doi: 10.1016/j.powtec.2014.05.037
Reference: PTEC 10292

To appear in: *Powder Technology*

Received date: 27 February 2014
Revised date: 22 May 2014
Accepted date: 26 May 2014

Please cite this article as: M. Dadkhah, E. Tsotsas, Study of the morphology of solidified binder in spray fluidized bed agglomerates by X-ray tomography, *Powder Technology* (2014), doi: 10.1016/j.powtec.2014.05.037

Study of the morphology of solidified binder in spray fluidized bed agglomerates by X-ray tomography

M. Dadkhah[1], E. Tsotsas

Thermal Process Engineering, Otto von Guericke University Magdeburg, Universitätsplatz 2, Magdeburg, 39106, Germany

Abstract

Properties of agglomerated products depend on the materials used (primary particles, binder) and on their internal structure. Previous studies have characterized the internal structure of spray fluidized bed agglomerates in terms of the placement of primary particles, but binder morphology has not been investigated until now. Therefore, solidified binder morphology in spray fluidized bed agglomerates is discussed in the present work on data gained by X-ray micro-computed tomography. The main results refer to glass beads as the primary particles and to HPMC with contrast agent as the binder. Gas temperature and drying rate are shown to have a very strong influence on the morphology of the bridges that connect primary particles, specifically on the macroscopic porosity (hollowness) of such bridges, but also on the microscopic porosity of seemingly full bridge parts. Individual bridge volume, bridge clustering, binder volume distribution and agglomerate filling ratio with binder are discussed, and a classification is proposed for the various solidified binder elements observed. A critical view to systematic errors stemming from limitations in spatial resolution of the applied imaging technique is provided.

1. Introduction

Fluidized bed agglomeration is one of the most widespread processes to conduct size enlargement, used to improve or modify the properties of small particles [1, 2]. Agglomeration of materials that undergo a glass transition can be achieved in fluidized beds by just increasing the temperature. Spraying water in the fluidized bed facilitates the transition of the solids from the glassy to the rubbery state, thus enhancing agglomeration. In case of solids that do not become rubbery at moderate temperatures but are soluble in water, sprayed water can lead to agglomeration by solution and subsequent re-solidification of primary particle material to bridges. Finally, spraying of a binder solution can produce agglomerates, when a wet particle collides with another particle and gets bound with it by a liquid bridge which solidifies during the removal of the water from the aqueous binder by drying. The present paper refers only to the last option, which is the most general, because applicable to any type of material.

[1] Corresponding author. Tel.: +49-391-67-58267; fax: +49-391-67-11160. *E-mail address*: m.dadkhah@yahoo.com