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## In-line agglomeration degree estimation in fluidized bed pellet coating processes using visual imaging

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### Abstract

Agglomeration of pellets in fluidized bed coating processes is an undesirable phenomenon that affects the yield and quality of the product. In scope of PAT guidance, we present a system that utilizes visual imaging for in-line monitoring of the agglomeration degree. Seven pilot-scale Wurster coating processes were executed under various process conditions, providing a wide spectrum of process outcomes. Images of pellets were acquired during the coating processes in a contactless manner through an observation window of the coating apparatus. Efficient image analysis methods were developed for automatic recognition of discrete pellets and agglomerates in the acquired images. In-line obtained agglomeration degree trends revealed the agglomeration dynamics in distinct phases of the coating processes. We compared the in-line estimated agglomeration degree in the end point of each process to the results obtained by the off-line sieve analysis reference method. A strong positive correlation was obtained (coefficient of determination  $R^2 = 0.99$ ), confirming the feasibility of the approach. The in-line estimated agglomeration degree enables early detection of agglomeration and provides means for timely interventions to retain it in an acceptable range.

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