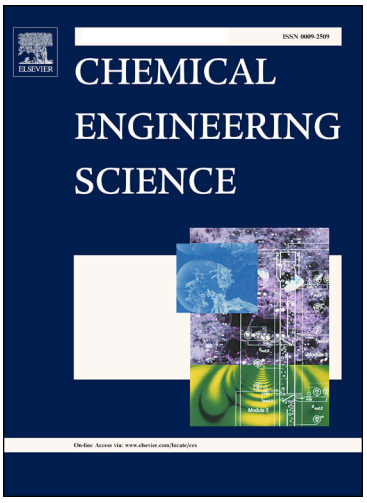

Investigation of Fluidized Bed Agglomerate Growth Process using Simulations and SEM-EDX Characterization of Laboratory-generated Agglomerates

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Investigation of Fluidized Bed Agglomerate Growth Process using Simulations and SEM-EDX Characterization of Laboratory-generated Agglomerates

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This study elucidates the sequential progression of agglomerate growth in fluidized beds through an investigation of physics and chemistry of particle-particle interaction. In fluidized bed gasification and combustion systems, agglomeration occurs by sticking of ash particles that are wetted by slag-liquid. Penn State has developed an agglomeration modeling methodology that considers non-uniform temperature, gaseous atmosphere and heterogeneity in ash chemical composition to predict slag-liquid formation and agglomerate growth rate. Simulations performed on three high rank coals with a consideration of these heterogeneous conditions, along with a microscopic (SEM) particle-level analysis of agglomerates facilitated an understanding of steps involved in their formation.

The results of this study indicated that agglomerate growth in fluidized bed systems is initiated at the particle-level by low-melting components rich in iron- and calcium-based minerals. Agglomeration can begin at lower temperatures than the fluidized bed operating temperatures of 850 °C and the severity of agglomerate growth issues can be identified based on the slag-liquid level in the system. Understanding the stages involved in the process of agglomerate growth discussed in this paper can help develop early detection methods and mitigation strategies.

Keywords- fluidization, ash agglomeration, SEM-EDX, granulation, FactSage, gasification