Agglomeration mechanism in biomass fluidized bed combustion – Reaction between potassium carbonate and silica sand

Agglomeration is one of the operational problems in fluidized bed combustion of biomass, which is caused by interaction between bed materials (e.g. silica sand) and the biomass ash with a high content of potassium species. However, the contribution of different potassium species to agglomeration is not fully understood yet. In the present work, the reaction between K₂CO₃ and silica sand has been studied extensively by thermogravimetric analysis. The reacted samples were analyzed by SEM-EDX to reveal the reaction mechanism. The results indicated that the reaction occurs in a solid-solid phase already at temperatures around 700°C. The reaction rate increases with increasing temperature, but decreases with an increase of CO₂ partial pressure. Using smaller particle size and well mixed solid reactants results in an increased reaction rate. It is observed that the reaction initiates in the contact area between K₂CO₃ and silica sand, forming a thin product layer. The layer acted as a reactive media further reacting with K₂CO₃ and silica sand. The results provide a basis for understanding of potassium induced agglomeration process in fluidized bed biomass combustion.

General information
Publication status: Published
Organisations: Department of Chemical and Biochemical Engineering, CHEC Research Centre, The Hempel Foundation Coatings Science and Technology Centre (CoaST)
Corresponding author: Wu, H.
Contributors: Anicic, B., Lin, W., Dam-Johansen, K., Wu, H.
Pages: 182-190
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Fuel Processing Technology
Volume: 173
ISSN (Print): 0378-3820
Ratings:
BFI (2018): BFI-level 2
Scopus rating (2018): CiteScore 4.72 SJR 1.415 SNIP 1.577
Web of Science (2018): Impact factor 4.507
Web of Science (2018): Indexed yes
Original language: English
Keywords: Fluidized bed combustion, Biomass, Agglomeration, Reaction mechanism, Potassium carbonate, Silica sand
DOIs:
10.1016/j.fuproc.2017.10.005
Source: FindIt
Source ID: 2396393856
Research output: Contribution to journal › Journal article – Annual report year: 2018 › Research › peer-review