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Lagrangian Approach to Study Catalytic Fluidized Bed Reactors¹ HOSSEIN MADI, EPFL, HOSSEIN MADI TEAM, MARCELO KAUFMAN RECHULSKI COLLABORATION, CHRISTIAN LUDWIG COLLABORATION, TILMAN SCHILDHAUER COLLABORATION — Lagrangian approach of fluidized bed reactors is a method, which simulates the movement of catalyst particles (caused by the fluidization) by changing the gas composition around them. Application of such an investigation is in the analysis of the state of catalysts and surface reactions under quasi-operando conditions. The hydrodynamics of catalyst particles within a fluidized bed reactor was studied to improve a Lagrangian approach. A fluidized bed methanation employed in the production of Synthetic Natural Gas from wood was chosen as the case study. The Lagrangian perspective was modified and improved to include different particle circulation patterns, which were investigated through this study. Experiments were designed to evaluate the concepts of the model. The results indicate that the setup is able to perform the designed experiments and a good agreement between the simulation and the experimental results were observed. It has been shown that fluidized bed reactors, as opposed to fixed beds, can be used to avoid the deactivation of the methanation catalyst due to carbon deposits. Carbon deposition on the catalysts tested with the Lagrangian approach was investigated by temperature programmed oxidation (TPO) analysis of ex-situ catalyst samples. This investigation was done to identify the effects of particles velocity and their circulation patterns on the amount and type of deposited carbon on the catalyst surface.

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