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On the measurement of solids circulation rates in interconnected fluidized beds: comparison of different experimental techniques

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Abstract:

Membrane assisted Chemical Looping Reforming (MA-CLR) is a novel concept recently proposed for efficient hydrogen production with integrated CO₂ capture. This novel technology is based on the circulation of a solid (an oxygen and heat carrier) between two different reactors, an air reactor and a membrane assisted fuel reactor. The solids circulation rates (SCR) between the two reactors determine the oxygen and heat transfer rate and temperature difference between the reactors and hence the overall performance of the new concept. However, the prediction of the SCR is still based on empirical correlations while many different techniques have been used in the literature to measure it. In this work a comparison of three different experimental techniques for the SCR is presented. A pseudo 2D interconnected circulated fluidized bed system has been constructed and the SCR have been measured using an optical technique, a pressure difference technique and a particles extraction technique. The three methods have been compared for different experimental conditions by varying superficial gas velocities, particle diameter and particle type. Results show that the SCR can be well predicted with the pressure drop method as the results are in good agreement with both the optical technique and the particle extraction technique for both spherical particles and non-spherical particles. The fact that the optical and pressure methods are not intrusive represents the main advantage for both. However, while the optical technique gives more information on the

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