bubble distribution along the height of the bed. This indicates that the ilmenite particles can have good gas-solid mixing properties in fluidized bed reactors. This makes ilmenite an even more suitable candidate as oxygen carrier for the chemical looping combustion process.

7 Conclusion

The fluidization properties of four types of particles have been studied using an experimental cold fluidized bed cylinder with pressure sensors. The density and the size of the particles resemble possible oxygen carriers for CLC. The particles studied in fluidized bed cylinder were sand, glass beads, white ZrO and brown ZrO. The minimum fluidization velocity is lowest for sand and highest for brown ZrO.

Tests using Electrical Capacitance Tomography have been performed for glass beads to study the bubble behavior. The number of bubbles in the lower part of the bed is higher than in the upper part of the bed.

Thermo Gravitametric Analysis was performed to study oxidation characteristics of ilmenite. Ilmenite particles could not be used in the fluidized bed study because of the high moisture content in sample. The oxygen carrying capacity of the particles have been calculated using experimental results.

Computational study (2D simulations) were run using the simulation software ANSYS Fluent. 3D simulations were carried out for white ZrO. Simulations with two particle phases were carried out for glass beads.

Minimum fluidization velocities are determined by using both experimental and computational results. In the experiments, the calculation is based on the pressure drop measurements. The computational results for the minimum fluidization velocities are higher than the experimental results due to neglecting the effects of particle size distribution and particle shape in the simulations. Simulations with two particle phases give results closer to the experimental results, but it is more time consuming. The 3D simulations resulted in nearly the same minimum fluidization velocity as the 2D simulations for white ZrO. The reason may be that: although the 3D simulations are more accurate, these simulations do not account for the particle size distribution. The bed expansion are observed both in experiment and simulation and they show closer results according to the Geldart classification for particles.

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