Micro and macro scale behavior of thermochemical materials in pure and composite forms for thermal storage applications

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Abstract

Thermal storage is a key technology for the transition to a 100 % renewable energy society. Nowadays used physical heat storage systems show disadvantages like high demand for space and heat loss over time. Thermochemical heat storage systems offer the potential to store ten times more heat per volume than physical heat storage units, and this without heat loss over time. Thermochemical systems are based on reversible chemical reactions, mainly gas-solid reactions. The easy separation of the gaseous and solid compound allows a good control of the storage system. Our project is focused on the investigation of thermochemical materials (TCM) in order to develop a high efficient thermal battery for building and industrial applications. Of particular interest are TCM such as salt hydrates and metal hydroxides, which tend to agglomerate or expand. Thus, the cycle ability and mass transfer are compromised. In addition, salt hydrates show low thermal conductivity and therefore present severe limitations for the heat transfer. Heat transfer in wet porous media is strongly influenced by the effects evaporation-condensation induced by the diffusive transfer of the vapor within the medium. By impregnating salt hydrates onto porous carrier matrices and novel synthesis of complex salts, we expect to improve those properties. At micro scale, characterization is performed using simultaneous thermogravimetric analysis and differential scan calorimetry (TGA/DSC. Macro scale experiments are conducted in a lab scale reactor for comparison and improvement.