IN-SITU NEUTRON IMAGING STUDY OF A THERMOCHEMICAL HEAT STORAGE REACTOR PROTOTYPE

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Salts of strontium chloride ammines ($SrCl_2$ / $SrCl_2(NH_3)_8$) can store and release heat based on the exo-/endothermal ab-/desorption of ammonia, and they can be considered for potential Thermochemical Heat Storage (THS) applications such as reutilization of industrial, low-grade waste heat and district heating [1].

In this work, strontium chloride ammine powders or $SrCl_2$-Expanded Natural Graphite (ENG) composites contained in a THS prototype reactor cell were studied by neutron imaging [2]. The neutron imaging experiments were performed at the instruments NECTAR (FRM-II, Münich, Germany) and NeXT (ILL, Grenoble, France). The high neutron scattering cross-section of hydrogen allowed us to observe the NH_3 uptake and release within the salt. 2D neutron radiography images were taken during NH_3 absorption/desorption cycling at selected temperatures and pressures of ammonia. The salts were embedded in a stainless steel or aluminum honeycomb structure, in order to facilitate the heat conduction from the heating element to the opposite regions of the cell. Absorption and desorption profiles for different regions of the THS reactor were obtained for each cycle by neutron radiography [3,4]. The results of image analysis are discussed with respect to the homogeneity of the ab-/desorption process over the volume of the cell and how this is affected by the degree of compaction of the powder or by the presence of ENG in case of the composite. The efficiency of the stainless steel and aluminum honeycomb structures to conduct heat during ammonia desorption is also compared.

References

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