

CFD simulation of hydrogen storage in liquid organic carriers

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The increasing availability of fluctuating energy such as wind and solar in the power grids leads to a growing demand of storage to compensate. The use of LOHC (Liquid organic hydrogen carries) is being investigated by AREVA GmbH together with partners within the scope of a network project. These liquids – which are similar to diesel – are enriched with hydrogen (hydrogenation), which is then stored under normal conditions in a safe manner. As required, the hydrogen is then yielded from the carrier fluid (dehydrogenation). The hydrogen can then either be reused as a gas or converted back, for example by means of a fuel cell. Both hydrogenation and dehydrogenation are catalytic reactions which take place under increased temperature. The advantages of using LOHC are easy transport and storage (liquid at ambient temperature and pressure). Container with a test facility was constructed and was first put into operation in 2013 (hydrogenation and dehydrogenation of LOHC). A field test is planned for the “ZAE SGS project” for 2015 and 2016; it will then be completed using an electrolyser and a fuel cell as an LOHC-based “Greenergy Box”.

The catalytic Hydrogenation of LOHC was modelled with reactingFoam using a one-step overall reaction. The highly exothermic reaction leads to a steep temperature gradient. The results of the simulation will be compared to measurement data from the test unit.