SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2017 HIGHLIGHTS

Task 58 – Material and Component Development for Thermal Energy Storage

THE ISSUE

More than half of our primary energy resources are used to generate heat. Therefore, technologies for increasing the share of sustainable heat sources and for improving the efficiency of thermal systems are of key importance. Thermal energy storage technologies are needed for both – to match the intermittent supply of sustainable heat and cold and to optimize the thermal system performance. Present thermal energy storage technologies based on water perform well, but on a relatively low level of efficiency, particularly for long-term storage. These systems can only be improved marginally thus new materials and systems are needed to enable a breakthrough.

OUR WORK

This joint project with the IEA Energy Conservation through Energy Storage Technology Collaboration Programme focuses on furthering the understanding and development of PCM and TCM materials, the development of measuring procedures for characterization and test methods for validating the performance of PCMs and TCMs as well as the development of effective design approaches for specific components.

Task experts from both materials research and storage applications are collaborating on the different levels of the storage system, components, materials and testing, and characterization. The work is divided into two parallel tracks – thermochemical (TCM) and phase-change (PCM) materials.

The main objectives of the Task are to develop and characterize storage materials to enhance TES performance, to develop materials testing and characterisation procedures, including material testing under application conditions, to develop components for compact thermal energy storage systems, and finally to map and evaluate the TES application opportunities concerning the requirements for the storage material.

Participating Countries

Austria
Belgium
Canada
Switzerland
Germany
Denmark
Spain
France
Italy
Netherlands
Sweden
Slovenia
Czech Republic
Turkey
United Kingdom

Task Period	**2017 – 2019**
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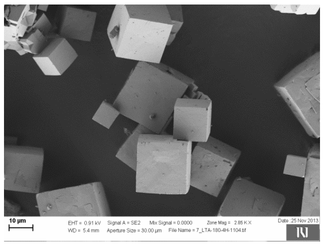
SHC 58 | ECES 33

KEY RESULTS IN 2017

New Sorption Materials Development



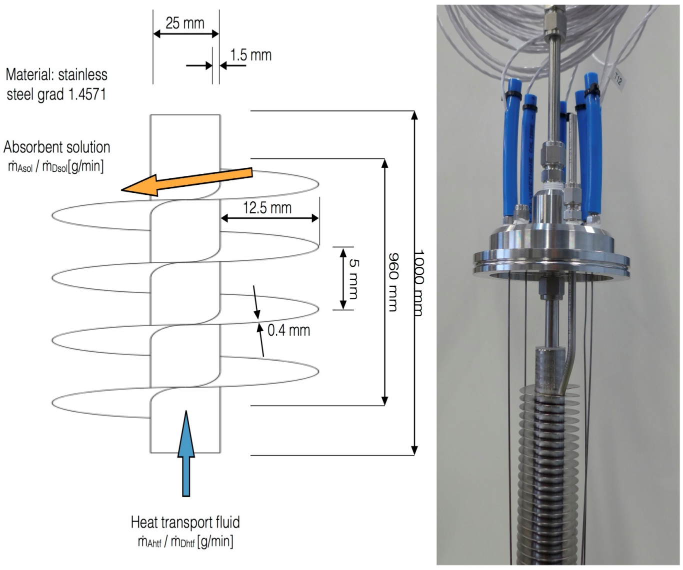
At the National Institute of Chemistry in Slovenia, novel solid sorption materials were developed. These materials have better thermal storage properties for domestic applications. The materials are porous, zeolite-like aluminophosphates with Linde type A (LTA) topology. The figure on the right is a microscopic image of the material.

Round Robin Tests for Solid TCM

Two different round robin tests were performed on two materials: NaMSX zeolite and SrBr2.6H2O salt hydrate. The goal for the zeolite measurement was to analyze the water uptake and heat of adsorption at two defined temperature and water vapor pressure scenarios. Large deviations could be seen in the data due to different definitions of the dry mass and misinterpretation of the specifications. For the salt hydrate, several participants measured dehydration enthalpy and temperature as well as mass change without recommendations using their standard approach. Results showed large deviations for dehydration temperature and enthalpy. In the second round robin test, these materials were measured again with a measurement procedure and defined temperature and gas conditions to achieve more comparable results in the first round.

Heat and Mass Exchanger for Liquid Sorption

At the EMPA in Switzerland, novel geometries for the heat and mass exchanger for a liquid sorption heat storage system based on sodiumhydroxide were designed. The standard heat and mass exchangers based on shell and tube proved to be underperforming for this kind of process, in which the residence time of the liquid absorbent in the heat and mass exchanger should be sufficiently long. The solution was found in a spiral fin tube heat and mass exchanger.



Left: Illustration of a spiral fin tube heat exchanger with absorbent and heat transfer fluid flow for improved absorption reaction. Right: Picture of the heat and mass exchanger with absorbent supply tube and temperature sensors installed. *(Source: EMPA)*