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PRESS RELEASE

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Thermal storage materials for a sustainable energy supply

Improvement of heat exchange by means of metallized zeolites

The heating season in Germany has started again and in terms of a sustainable energy supply, concepts for an effective heat utilization are needed. In this context, thermal storage facilities, which are flexible in use and have high storage capacities, are moving into focus. Thermal storage systems based on zeolite materials offer great potential, but have so far suffered from a lack of efficient heat transfer between storage material and heat exchanger. In the framework of the ZeoMet project (FKZ 100346109) funded by the Saxon Ministry of Economic Affairs, Labour and Transport, the Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP has found a new way to coat zeolite granulate, so that an efficient heat transfer is made possible.

Heat represents 55% of final energy consumption in Germany and therefore plays a very decisive role in the transition to a sustainable energy supply. In addition to the priority of avoiding or at least minimizing heat losses, effective heat utilization also requires suitable storage facilities to bridge the time or spatial offset between heat generation and consumption. High flexibility and storage capacity are promised by zeolite-based thermal storage systems, in which the energy is bound inside the highly porous material in the form of an adsorption capacity for water vapor. A temporarily occurring surplus of heat, for example from a solar thermal system during summer or from industrial processes producing exhaust heat, can be used to dry the zeolite granulate. This process corresponds to a loading of the storage tank. If steam is added to the material, an exothermic adsorption process releases heat, which can be used for heating purposes. During storage, the energy is not present in form of thermal energy and is therefore not subject to the unavoidable gradual heat losses. Thus, longer storage intervals can be realized than with direct heat storage, for example in water storage tanks.

A hitherto unsolved problem of the sorption storage concept is the heat transfer between storage material and heat exchanger. High thermal transfer resistances between the metallic structures supplying and removing heat and the zeolite in granular form as well as in the zeolite bulk itself impede effective loading and unloading. Attempts to apply zeolite material directly as a thick layer on metallic carriers fail due to the lack of cycle stability of this metal-mineral composite. With another solution, which consists of zeolite-filled metal tubes, both the volume ratio as well as the mass ratio of carrier material to storage material are inadequate.

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A new approach is being taken by the Fraunhofer FEP in the ZeoMet project funded by the Saxon State Ministry of Economic Affairs, Labour and Transport: Zeolite granulate is metallized in a rotary drum process in a vacuum and thus receives a thin aluminum layer (< 0.1 mm).

Project manager Dr. Heidrun Klostermann explains: "The heat transfer is ensured for each individual pellet and also between the pellets by the high thermal conductivity of aluminum. With the results of first measurements we have proved that the porous base material is still accessible to water molecules through open channels in the layer and that the sorption capacity of the pellets is maintained". With the metallized pellets, the heat transfer at the loading and unloading points as well as in the bulk itself is facilitated. Furthermore, sintering of the metallized pellets to form modular building blocks for a storage system is possible.

Currently, the scientists of the Fraunhofer FEP are engaged in investigations on the scale-up when using different granulate grain sizes and properties in order to be able to react to specific requirements of different storage applications. Interested companies are invited to contact the responsible scientists. They will gladly explain the possibilities and potentials of the technology and get into deeper discussions in order to ensure that future work is both practice-oriented and relevant to industry.

Project ZeoMet

Improvement of the energy flow in zeolite thermal storage systems
by vacuum metallization of the granulate (ZeoMet)

Funded by: Saxon State Ministry of Economic Affairs, Labour and Transport
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Zeolithe:

Zeolites are crystalline aluminosilicates that occur naturally in numerous modifications, but can also be produced by synthetic means.
http://de.wikipedia.org/wiki/Zeolithe_(Stoffgruppe)

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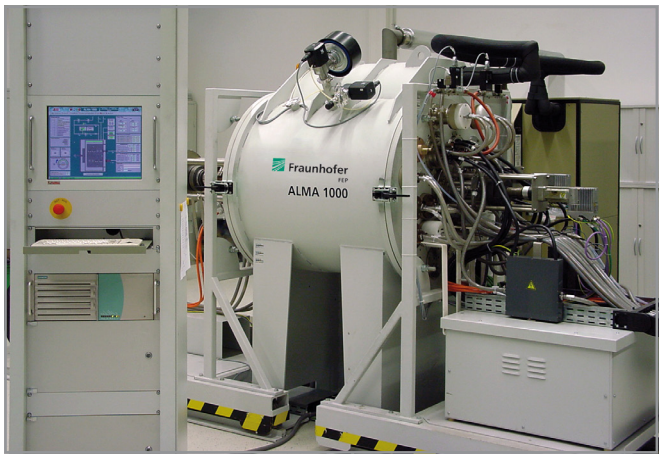

Rotating drum system ALMA 1000 for the metallization of bulk materials in vacuum
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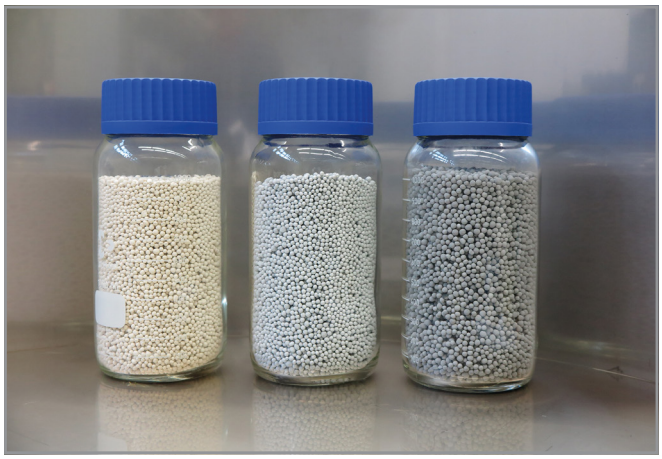
Picture in printable resolution: www.fep.fraunhofer.de/press



Zeolite granulate in original condition (left) and coated with aluminum (center, right)
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Aluminum coated granulate, as bulk material and sintered
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