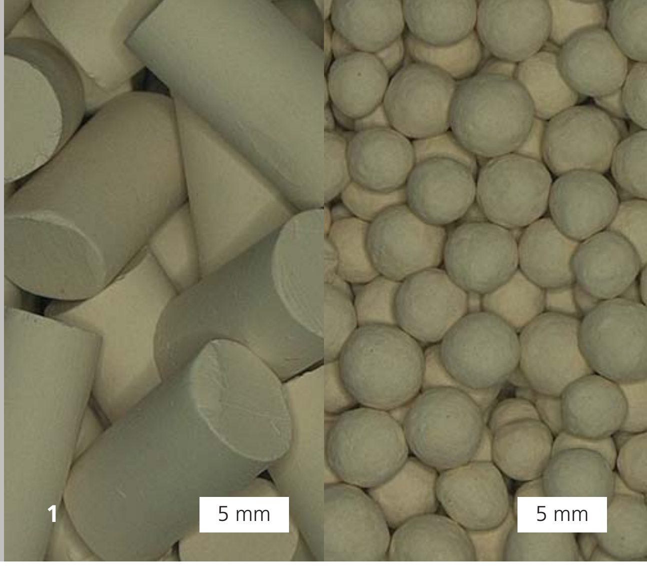

METAL-COVERED PELLETS – MATERIAL COMPOSITES FOR HEAT STORAGE

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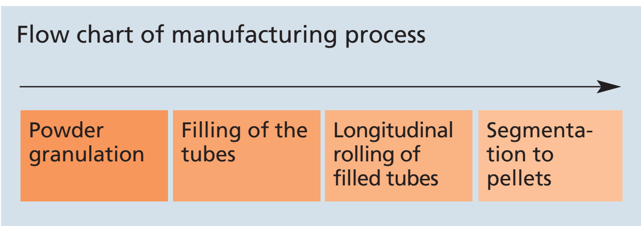
Bulks from commercial catalyst and sorbent pellets (e.g. zeolite or activated carbon) have a low thermal conductivity and mechanical stability. For that reason, it is the aim of a strategic Fraunhofer project with Fraunhofer IWU and IGB to develop pellets with high inner porosity and specific surface area as well as good mechanical stability. In a fixed-bed reactor, these pellets are expected to have significantly better thermal conductivity values than standard pellets. Furthermore, a manufacturing method is to be developed which allows for fast and cost-effective mass production.

One solution is to cover the sorbent or catalyst powder of the preferably cylindrical pellet with a good heat-conducting material such as copper or aluminum. Due to this metal shell, the pellets have a high wear resistance and fracture toughness when transported or filled into the reactor. Good thermal conductivity results from the surface contact of the pellets as the highly heat-conducting shells form a good heat-conducting skeleton.

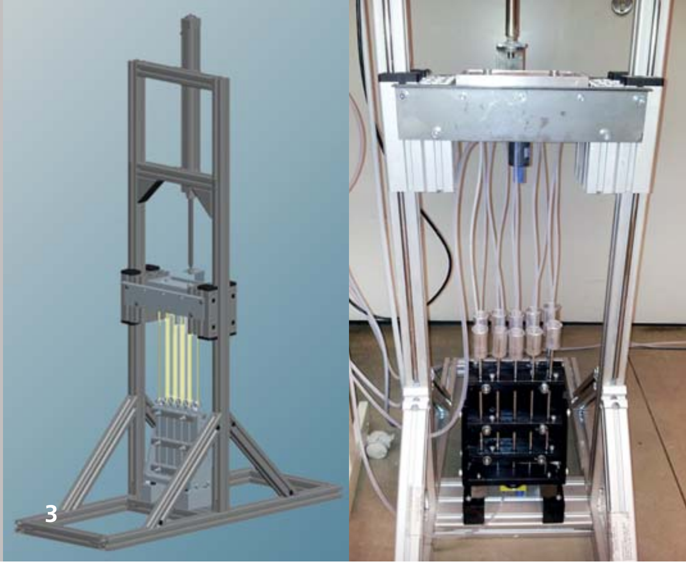
The flow chart below, worked out in collaboration with Fraunhofer IWU, shows the manufacturing process of such pellets.



After a suitable powder has been granulated, it is filled into prepared Al tubes (e.g. with a diameter < 4.5 mm) by means of a filling apparatus. Afterwards, the filled tubes are reduced in diameter by longitudinal rolling. So, the granulate is fixed in the metal shell by compaction. Then, the tubes are cut to the desired length resulting in pellets.

A NaY zeolite from Chemiewerk Bad Köstritz GmbH with aluminosilicate (1) or silicate (2) binder was chosen as model substance. In preliminary tests in which the powders were granulated and uniaxially pressed to small cylinders (D = 10 mm, H = 10 mm) the influence of the degree of compaction on stability and specific surface area was studied. As expected, the increasing compaction pressure positively influences the green densities (0.66–0.8 g/cm³) and thus also the compressive strength of the cylinders (1–2.5 MPa). After compaction and annealing, the specific surfaces of both binder types tested show only slightly lower values than the starting granulates. The difference to the starting powder CBV100 is adequate to the binder content.

Furthermore, the filling and flow behavior of the granulates (1) and (2) was investigated using filling and vibration tests in prepared Al tubes. Approx. 70 % of the compaction density of 10 MPa compaction pressure was achieved using suitable vibration parameters. However, this is not sufficient to fix the granulate in the tubes. First tests, in which the filled tubes were rolled additionally, showed that a reduction to a diameter of approx. 3.7 mm is sufficient to compact the granulate in the tube (density of powder in the Al tube 0.66 g/cm³) so that it is fixed and can be cut to a pellet length of e.g. 10 mm.

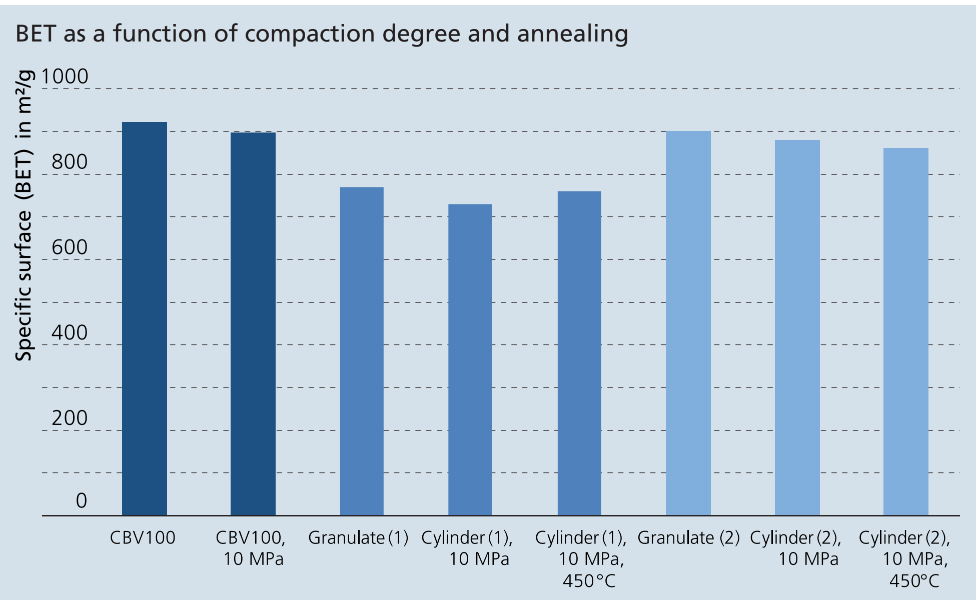


Within the framework of the project, the properties of the coated pellets are to be examined in terms of their flow and compaction properties, wear behavior, and applicability in a model heat accumulator (at Fraunhofer IGB). These tests are conducted in comparison with standard pellets and spherical granules.

The resulting additional costs as compared to standard pellets are a very important criterion for the applicability of the composite pellets. For this reason, the manufacturing costs are estimated for an industrial production process.

Services offered

- Development of composite materials for sorbent and catalyst applications
- Development of manufacturing methods for industrial production of the composites
- Application tests



1 *Pellets made of zeolite (Fraunhofer IKTS).*

2 *Al and copper-coated zeolite pellets (Fraunhofer IKTS).*

3 *Filling apparatus for ten metal tubes (Fraunhofer IWU).*

4 *Test stand "Sorptive heat accumulator" (Fraunhofer IGB).*

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