

Composite Pellets for Fixed Beds

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Granules, catalyst carriers or adsorbents are frequently made of highly porous ceramic materials that lack high heat conductivity and abrasion resistance. Therefore, a consortium of three Fraunhofer institutes are developing a concept of composite materials, which applies partly covering thin metal foils around cylindrical pellets to increase heat conductivity of fixed beds as well as abrasion resistance of the pellets. Furthermore, the choice of metal material can provide additional functionality, like special catalytic effects.

As first model systems, aluminum and copper foils were used around cores made of commercial zeolite (for heat storage, see figure 1) and γ -alumina (as catalyst carrier). In principle, other metals can be used for the shell, as well as many different ceramics or mixed oxides inside the pellets. Porous ceramic core can be catalytically functionalized by state-of-the-art techniques.

An 8 liter fixed bed built up of 5 mm cylindrical zeolite pellets with 0.25 mm aluminum metal shell was tested for a heat storage application, compared to zeolite pellets without shell (see figure 2). It could be shown that water absorption/desorption was not disturbed, but a higher velocity of loading and unloading could be reached because of a five times higher heat conductivity of the bed. Additionally, temperature gradients in the bed were diminished.



Figure 1: Composite pellets



Figure 2: Standard pellets for comparison