

A more efficient way to shape metal-organic framework (MOF) powder materials for hydrogen storage applications

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Abstract

Shaping of Zr-MOF powder material into spherical pellets with diameters of 0.5–15 mm in the presence of 10 wt.% sucrose as a binder was successfully demonstrated using a granulator. Zr-MOF pellets were produced in a kilogram batch within 30 min operation time. This granulation approach is a more efficient way to shape MOF-type powder materials into application-specific configurations compared to the mechanical pressing method. The pellets could be conveniently packed in a small hydrogen storage tank. The physical degradation characteristics of the Zr-MOF pellets were studied by drop test and simulated tumbler drum test. The results showed zero breakage of the pellets after 70 consecutive drops at a height of 0.5 m and 5% breakage after 60 min of tumbling time at a speed of 25 rpm. Although the compromised value of the surface area led to a decreased hydrogen storage capacity, this shaping approach still holds promise given an appropriate choice of binder.