Intellectual Property and Enterprise

Preparation of large porous zeolite bulk bodies

Zeolites are porous crystalline aluminosilicates with a multitude of functions—including catalysis, separation, adsorption, and ion exchange—that arise from the porous nature of the structures. Consequently, zeolites are widely used as industrial and environmental materials.

Zeolites with such functions are generally are in powder form consisting of 10 μm or smaller crystals produced by hydrothermal synthesis. To-date the synthesis of zeolitic membranes and bulky zeolites has been widely investigated to exploit the applications of the unique structures and functions of zeolites. Notably, considerable more research has been conducted on zeolitic membranes, and in contrast, bulky zeolites have been studied much less due to the difficultly in sintering zeolites.

Here, the authors describe the preparation of large porous ZSM-5 zeolite bulk bodies by the hydrothermal method. As shown in Fig. 1, porous ZSM-5 bulk bodies with sizes of the order of centimeters were successfully prepared by a one-pot hydrothermal method at 200°C for 5 days using raw materials for synthesizing ZSM-5 powder.

The resulting ZSM-5 bulk bodies have macropores with about 8 μm in diameter, and their apparent density and porosity were estimated to be about 1.5 g/cm^3 and 45 %, respectively. It is important to evaluate the mechanical properties of the ZSM-5 bulk bodes if they are to be utilized as porous bulk materials. The bulk bodies of ZSM-5were trimmed to form pellets with a diameter of 12 mm and a thickness of 5 mm. The pellets were subjected to a drilling test using a 5-mm-diameter twist drill. A doughnut-shaped pellet was non-destructively processed, as shown in Fig. 2. The bending strength of the ZSM-5 bulk bodies was about 5 MPa.

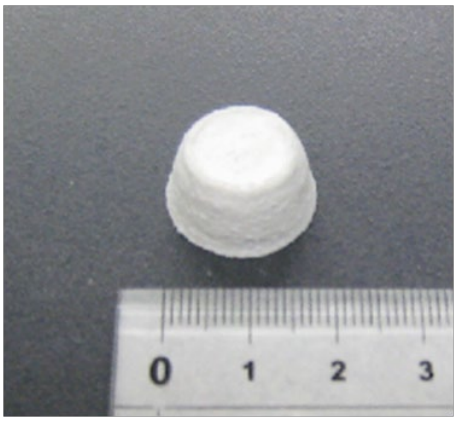

Fig.1. Photograph of as-prepared ZSM-5 bulk bodies.

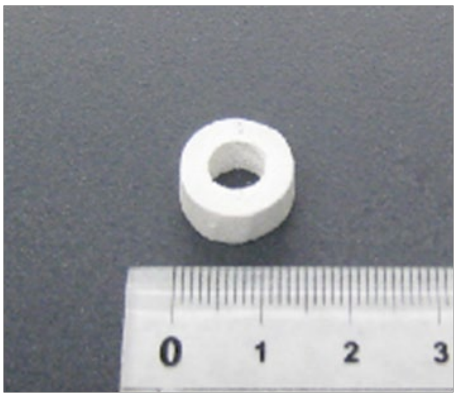

Fig. 2. Photograph of ZSM-5 bulk bodies after trimming and drilling tests.

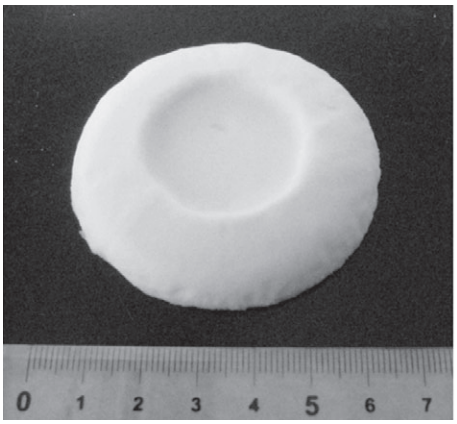

Fig. 3. Photograph of as-prepared larger ZSM-5 bulk bodies.

These results suggest that the ZSM-5 bulk bodies are suitable for use as practical porous materials. Furthermore, the preparation method found can be applied to the fabrication of larger ZSM-5 bulk bodies, as shown in Fig. 3.

Further information

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