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Aug 1st, 2005

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Ultrasound-based process makes another promising HDS catalyst

By Chemical Engineering Editorial Staff

In addition to hollow-sphere nanostructured crystals of molybdenum disulfide (CE, April p. 15), a highly porous form of MoS₂ has also been produced by researchers at the University of Illinois at Urbana-Champaign (edlinks.che.com/4819-541). As was the case with the hollow-sphere version, the porous MoS₂ shows "exceptionally high" hydrosulfurization (HDS) activity, says chemistry professor Kenneth Suslick.

The porous MoS₂ was made by a process called ultrasonic spray pyrolysis (USP), which uses a common household humidifier to spray small droplets of precursor solution. The droplets are delivered by a carrier gas into a furnace, where the solvent is evaporated and the dissolved substances react. When a solution containing (NH₄)₂MoS₄ (as a precursor to MoS₂) and colloidal silica (as a sacrificial template) is used, a spherical SiO₂/MoS₂ composite is formed (photo, left). The SiO₂ is then etched away with hydrofluoric acid, leaving a MoS₂ network with a high number of MoS₂ edges exposed (the dark fringes of photo, right).

In laboratory trials performed in a single-pass microreactor at 1-atm pressure, the highly porous MoS₂ network is found to be higher than that of conventional MoS₂, and when promoted with cobalt, higher even than RuS₂, an alternative to HDS catalyst more expensive than MoS₂. The USP process is said to be easily scaled up, and applicable to other materials.

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