Technology invention

The University of Sheffield (TUoS) has developed a technology (GNRG-02) that can unlock the potential for mesoporous silica for a wide range of current and emerging industrial applications.

Context

The key barrier to progression of MCM-41 is its manufacturing process, specifically in terms of activation of the pore structure after synthesis. This is commonly achieved through calcination to thermally decompose surfactant molecule; however, this increases the overall cost of production. As a result MCM-41 production on the kg-scale or higher is currently impossible economically. Indeed, multiple silica manufacturers (both small-scale and large multinationals) have identified this as a critical barrier towards their development in these areas, therefore industrial adoption of this technology once protected is highly likely.

Market Potential

These materials exhibit a diverse range of surface chemistry and (meso)pore geometry, enabling the materials to host chemical reactions, separations, and guest molecules. This has led to potential applications of mesoporous materials as CO$_2$ sorbents for large point sources (e.g., power plants), use as next-generation targeted drug delivery systems, and as (bio)catalyst supports enabling shape-selective or cascade reactions. However, despite these many areas of potential application (leading to ca. 14,000 citations for the paper describing its initial synthesis), no commercialisation of MCM-41 or other mesoporous silicas has been achieved to date at large scales.

Technology Description

The GNRG-02 technology involves a room-temperature solvent extraction for MCM-41 activation and it can enable scale-up in a sustainable and economical fashion. A controlled extraction of the template is possible using this method.

Advantages

- A room-temperature solvent extraction technique for MCM-41 activation is inherently sustainable and economical by design (reported for the first time).
- It avoids all drawbacks of calcination-based techniques.
- Fully removes the surfactant from as-made MCM-41 frameworks.
- This is the first report of an extraction technique that does not require large energy inputs typical of solvent reflux, irradiation or ultrasonication, or supercritical extraction using CO$_2$.
- Our technique involves only common industrial chemicals and processes, avoiding all of common practical issues.
- Costs of purification can be reduced by up to 97% compared to calcination, greatly improving the prospects of MCM-41 as an industrial material going forward.

Technology Status

This technology currently operating at technology readiness level 2.

Know-how is available to support the exploitation of the invention and any subsequently produced IP in collaboration with the chosen industrial partner.

Contact

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