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Method of Making Porous Polymer-metal and Carbon-Metal Composites

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Inventors

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Intellectual Property Status

Patent Pending

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Background

Transition metal and transition metal oxides have many useful applications, including catalysis, photo catalysis, sensors, and the preparation of electrodes. In many of these applications, a high surface area is desirable in order to increase the efficiency and cost-effectiveness of these applications. Higher surface areas can be realized by the formation of mesoporous structures. However, fully metallic or transition metal oxide materials are not ideal for many of the aforementioned applications as only the surface is active. Thus, composite materials are desired.

While it is recognized that organized mesoporous materials containing transition metals would be highly desirable for many applications, this presents a challenge when forming composites to control the location of the active material. Furthermore, the presence of high concentrations of metal ions during synthesis yields an uncontrolled pore size and morphology for mesoporous structures. Additionally, post-synthesis deposition of metal ions within mesopores limits the ability to precisely control the deposited metal and requires additional processing steps. For example, significant improvements in catalytic efficiency could be realized through improved control of the catalyst dispersion.

Invention Description

Researchers at Arizona State University have developed a method to control the metal quantity on the pore surfaces of mesoporous structures based upon interfacial thermodynamics. This method uses a non-ionic surfactant template containing a specialized metal/metal oxide precursor and a molecule that can be cross-linked or carbonized. After carbonization, removal of the template material yields a mesoporous inorganic support with well defined pore sizes, and the pore walls decorated by the metal or metal oxide.

Potential Applications

- **Catalysts and photocatalysts**
- **Electrode formation**
- **Sensors**
- **Hydrogen storage**

Benefits and Advantages

- **Simple process** – single step process with relatively short cycle times
- **Control of porosity / pore size** – well defined templated pore size and morphology
- **Compatible with broad range of materials –** different metal (oxide) possible with limited changes in processing