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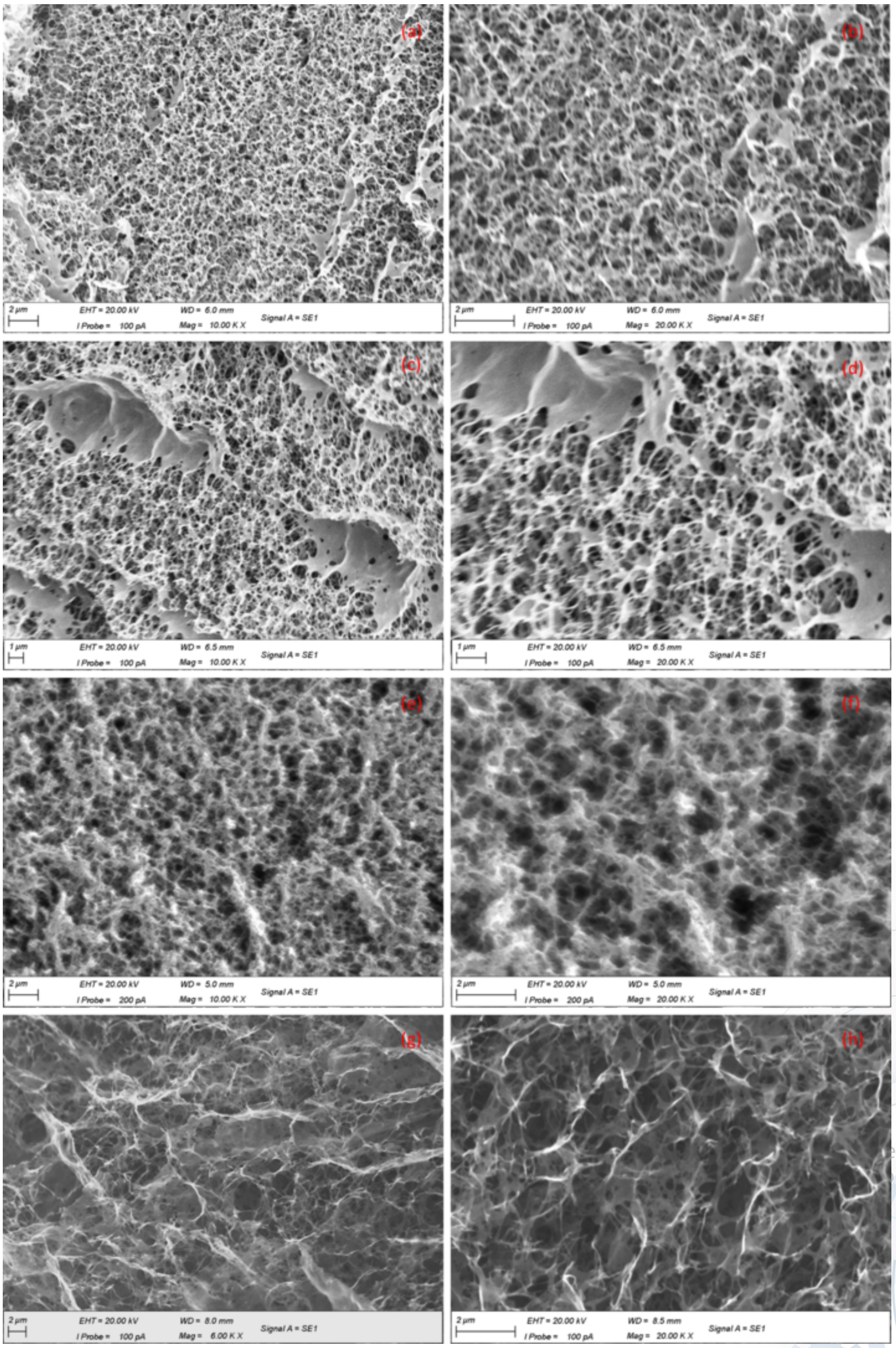
Simple and Affordable Method for Making Aerogel

Manufacturing

Nanotechnology and New Materials



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Patent granted

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Table 1: The porous properties of the resulting PEDOT:PSS aerogels given by nitrogen adsorption/desorption test.

Opportunity

Aerogel is a highly desirable material that possesses ultra-low density, good thermal insulation, and a strong structure. But the two common methodologies of manufacturing aerogels both have limitations. The supercritical drying method requires a drying container that can withstand more than 8 megapascals. This necessarily means that this method is both relatively expensive and difficult to scale. On the other hand, the freeze-drying method can cause cracking in the finished product.

In contrast, the methodology outlined in this invention only requires a drying container that can withstand 1 atmosphere. Moreover, the proposed methodology involves both simpler and smaller equipment, leading to additional benefits in terms of cost and scaling. Finally, the aerogel that this methodology produces is fully dried at the conclusion of the process, while the current approach leads to the final product still containing some traces of solvent.

The more efficient production of aerogel has implications for industries involved in thermal insulation, chemical absorption, thickening agents, and scientific research in fields such as particle physics.

Technology

This invention solves problems associated with other aerogel manufacturing methodologies by replacing the water inside the gel with other solvents. The precise solvent used is selected in accordance with the gel being used. For example, the solvent should be miscible with the original solvent. The solvent must also have a freezing point below the one that will be used in the vacuum chamber for the drying process.

After the water is replaced by the solvent, the wet gel is frozen solid. The solid gel is then dried in a vacuum chamber that keeps the solvent frozen. This prevents the gel from melting.

Advantages

- The quality of the final aerogel product is similar to or better than that produced by current methodologies.
- The drying container requires far less air pressure than the one employed by the supercritical drying methodology.
- The equipment required for the process is simpler than that used in other methodologies.
- The final product is fully dried, whereas the samples produced by the supercritical drying method still contain small traces of solvent.

Applications

- Thermal insulation
- Chemical absorption

- Thickening agents
- Research laboratories