Porous support for phase change materials with integrated enhancement of thermal conductivity and capacity

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Phase change materials (PCMs) have been widely developed in thermophysical storage technologies. However, issues with leakage in the liquid phase and low thermal conductivity of pure PCMs block their real-world applications. Typically, porous support can stabilize the PCMs through surface tension action and capillary forces. However, support with high porosity usually leads to amorphous structures and low thermal conductivity, which is inadequate for meeting most power conversion targets. Therefore, designing novel support with both an integrated high loading capacity and large thermal conductive properties still remains a challenge. Recently, our group developed a one-design many-functions strategy to create metal-organic frameworks (MOFs) derived porous carbons and 3D porous carbon support for PCMs. For example, a highly porous carbon (HPC) from MOFs have been fabricated by using a control carbonization method. The large mesopores of the support guarantee a high loading percentage of PEG molecules, and the micropores induced the surface tension and capillary force to ensure the high thermal stability of the shape stabilized PCMs. The phase change enthalpy of shape stabilized PCMs is close to pure PEG and the thermal conductivity of PEG can be further improved through porous carbon. 3D conductive network carbon has been synthesized by employing a direct-calcined CQDs-derived porous carbon from the aldol reaction. 3D porous carbon offered large loading space for PCMs, meanwhile, the graphitized sp2-hybrid carbon nanosheets provide thermally conductive network and improve thermal conductivity. These SS-PCMs exhibit excellent thermal conductivity and power capacity.

Biography

Ge Wang has completed her PhD in Chemistry from Michigan Technological University in 2002. Currently she is a Professor and PhD supervisor in the School of Material Science and Engineering at the University of Science and Technology Beijing. In 2012, she became a special Chair Professor endowed by the Chang Jiang Scholars Program of the Ministry of Education. Her research interests focus on creating complex materials structures with nanoscale precision using chemical approaches, and studying their functionalities including catalytic, energy storage and energy saving properties, etc.

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