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Experimental study on cooling performance of microencapsulated phase change suspension with Al_2O_3 hybrid shell in a PEMFC

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In order to remove the heat generated by proton exchange membrane fuel cell (PEMFC) stack, we used the purchased paraffin for the preparation of a novel microencapsulated phase change suspension (MPCS) with high thermal conductivity; the shell material is a blend of polyacrylate and polyurethane doped with aluminium oxide nanoparticles. It was confirmed by Fourier transformation infrared spectroscope (FTIR) and energy dispersive spectrometer (EDS) spectra that modified Al_2O_3 nanoparticles had been well fixed in the cross-linked network structure of shell. Physical and electrochemical properties of homemade MPCS were characterized and investigated, including morphology, diameter distribution, phase change temperature, latent heat, viscosity and thermal conductivity. The results show the good heat storage capacity and cooling potential of the prepared MPCMs. In addition, we built a PEMFC platform to test the cooling capacity of the MPCS. The MPCS used as cooling medium to test the heat dissipation of the 500 W power generation system, and compared with the deionized water as the cooling medium. The results show that the use of MPCS saves the weight and volume of coolant and the power consumption of the pump, which has great potential in PEMFC thermal management.

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