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High performance proton-conducting composite based on vanadium-substituted Dawson-type heteropoly acid for proton exchange membranes

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Abstract: Proton exchange membranes (PEMs) are the key parts in proton exchange membrane fuel cells (PEMFCs). In this work, a proton-conducting composite membrane rGO-$P_2W_{16}V_2$@SPEEK was synthesized from vanadium-substituted Dawson-type heteropoly acid ($H_8P_2W_{16}V_2O_{62}$•$20H_2O$, abbreviated as $P_2W_{16}V_2$), sulfonated polyether ether ketone (SPEEK) and reduced graphene oxide (rGO). Characterizations proved the integrity of the Dawson-structure heteropoly acids (HPAs) in composites and the uniform inorganic-organic hybrid distribution. The membrane shows excellent proton conductivity of 7.90×10^{-2} S•cm^{-1} at 50°C and the proton conduction was proved to comply with the Grotthuss mechanism. Up to now, this is the first time that a Dawson-type HPA was reported for the application of PEMs and this work extended the application of polyoxometalate-based materials in the field of fuel cells.

Keywords*:* Heteropoly acid; Proton exchange membrane; Graphene; Polymer-matrix composites (PMCs); Electrical properties;

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