

Functionalised Hybrid Poly(ether ether ketone): a Hydrogen Storage Material

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Abstract

The use of hydrogen as a non-polluting fuel for automotive is limited by the lack of a safe and efficient system for on-board storage. Among the investigated materials, polymers have recently received much attention due to their composition based on light elements. In this work, the attention was focused on Poly(etheretherketone) (PEEK) as a polymeric matrix with the aim of producing both a low cost and weight hydrogen storage material. A manganese oxide was selected as a material able to store hydrogen but its stability is needed to be improved. For this aim, a functionalised PEEK having SO₂Cl groups was prepared and manganese oxide, in-situ produced, was anchored to the functional groups through a substitution reaction.

The functionalised and composite polymer were characterized by CHNS-O, BET, SEM-EDX, XRD and TEM.

The oxide introduction modifies the starting material in terms of XRD profile, the morphology and the surface area. In fact a slight increase was registered revealing the possibility to store hydrogen up to a 1.2%wt in cryogenic conditions (77 K).

Preliminary hydrogen sorption/desorption tests over 0°C, using thermo-gravimetric measurements, have supplied encouraging results (0.2wt% at 50°C and 60bar) about the capability of this composite polymer to store H₂. Volumetric measurements were used to investigate the influence of different oxide percentages in non-drastring conditions (T=110°C e P=60bar). Promising results were obtained with a 78%wt manganese oxide sample, reaching a value of about 1%wt constant over time.

A prototype was in-house developed to investigate the material properties in real conditions.