

New sulfonic acid moiety grafted on montmorillonite as filler of organic-inorganic composite membrane for non-humidified proton-exchange membrane fuel cells

김영권, 윤덕현¹, 이승욱¹, 이재성^{1,*}
호남석유화학; ¹포항공과대학교
(jlee@postech.ac.kr*)

A new organic sulfonic acid moiety is grafted on the surface of montmorillonite (MMT) by a condensation reaction of the surface hydroxyl group of MMT with the thiol group of 3-mercaptopropyltrimethoxy silane (3-MPTMS), and simultaneously attaching sulfonic acid group by a ring opening reaction of 1,3-propane sultone. The new method produces MMT functionalized with sulfonic acid of a longer chain length in a simple one-step reaction and shows higher ion-exchange capacity and thermal stability than MMT grafted by a two-step method of 3-MPTMS condensation followed by oxidation with H₂O₂. Using these functionalized MMTs as inorganic fillers, organic-inorganic composite, proton-conducting membranes are cast together with Nafion®. The composite membrane with MMT grafted with the long-chain sulfonic acid shows increased water uptake, while maintaining comparable ionic conductivity relative to a pristine Nafion membrane. This leads to much enhanced performance of a proton-exchange membrane fuel cell without external humidification of reactant gases.