The preferable preparation method of SPEEK/BPO_4 composite membranes for enhancement of proton conductivity via an in-situ sol-gel process

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Sulfonated poly(ether ether ketone) (SPEEK)/boron phosphate (BPO_4) composite membranes were prepared via an in-situ sol-gel process. Several variables such as reaction time, reaction temperature and solution-cast form of SPEEK were investigated to explain the relationship between the size of BPO_4 and the proton conductivity. The size of BPO_4 and proton conductivity were not dependent on reaction time and reaction temperature in the in-situ sol-gel process, while the solution-cast form of the membranes strongly influenced the size of BPO_4. The composite membrane using H^+-form SPEEK included the bigger size of BPO_4 in the matrix. Moreover, water uptake of the composite membrane using H^+-form SPEEK was higher than that of the composite membrane using Na^+-form SPEEK due to the bigger size of BPO_4, and the proton conductivity was enhanced in the composite membranes using H^+-form SPEEK.