Bismuth phosphates as intermediate temperature proton conductors: From polycrystalline powders to amorphous glasses

Proton conducting electrolyte materials operational in the intermediate temperature range of 200–400 °C are of special interest for applications in fuel cells and water electrolysers. Bismuth phosphates in forms of polycrystalline powders and amorphous glasses are synthesized and investigated by scanning electron microscopy, X-ray diffraction, FT-IR, thermogravimetric analysis and AC impedance. Under dry atmosphere the pure crystalline and amorphous phosphates exhibit an intrinsic conductivity of up to $10^{-5}$ S cm$^{-1}$ at 250 °C. In the presence of atmospheric humidity the conductivity of both types of phosphates is significantly enhanced, reaching about $10^{-2}$ S cm$^{-1}$ at a water vapor partial pressure above 0.5 atm. During a period of more than 100 h with four humidity cycles from zero to 0.58 atm of the water vapor partial pressure, the phosphates show good stability, suggesting the potential as an intermediate temperature electrolyte.

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