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Entropy restrictions as a thermal mechanism controlling ionic conductance in fuel cells

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Abstract

A macro transport processes theory is formulated in which both transport in confined spaces and phase transformations are conjugated to explain the sudden increase in the proton conductivity in ionic solids based on doped cesium phosphates. Impedance studies were done to evidence the correlation between the phase and superprotonic transitions and show the anomalous nature of the proton disffusion in the superprotonic phase. Additionally, it is shown that the change of entropic restrictions associated with solid–solid phase transformations controls the observed increase of conductivity in solid electrolytes during the superprotonic transition. We deduce a formula for the conductivity that fits the experimental data of the conductivity doped cesium phosphates remarkably well in different situations.

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