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Interaction of water with Ceramic Proton Conductors

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Proton conductors are promising solid electrolyte materials for ceramic fuel cells operating at intermediate temperature. Protons are introduced in the form of water to those oxygen defected sites.

We found by electrochemical impedance spectroscopy at high pressure that compressing the lattice decreases proton conductivity, which indicates that the protons need "space" to move freely in the lattice. We are probing the proton diffusion in the atomic scale by quasielastic neutron scattering under high pressure. Also, our recent results in neutron scattering from SINQ reveal that the onset temperature of lateral proton diffusion coincides with its thermal lattice expansion, which exhibits a contraction for protonated BaZr_{0.9}Y_{0.1}O_{2.95} at T = 648 K, suggesting a correlation of toughening of the lattice and proton conductivity.

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