# Modeling and Experimental Study of Hydrogen Permeation through Proton Conducting Ceramic Membranes

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Applications of the proton-conducting ceramic membranes in hydrogen separators or membrane reactors require a good understanding of the dependency of their hydrogen permeation flux on various parameters. However, hydrogen permeation through proton-conducting ceramic membrane is complex due to the involvement of at least three charged species: proton, electron-hole and electron. In this paper we will present a model for hydrogen permeation through proton conducting ceramic membranes based on the ambipolar diffusion theory. A general equation is derived that correlates hydrogen permeation flux to concentrations and diffusion coefficients of the three charged species. The equation can be simplified to analytic expressions relating the hydrogen permeation flux to the hydrogen partial pressures at upstream and downstream sides for special cases. Hydrogen permeation data for several mixed conducting proton-conducting membranes: SrCe0.95M0.05O3-d (M=Y, Tb and Tm), were experimentally measured at high temperatures. The results of the theoretical model are compared with the experimental hydrogen permeation data and good agreement was obtained.