Correlation between oxygen transport properties and microstructure in $La_{0.5}Sr_{0.5}FeO_{3-\delta}$

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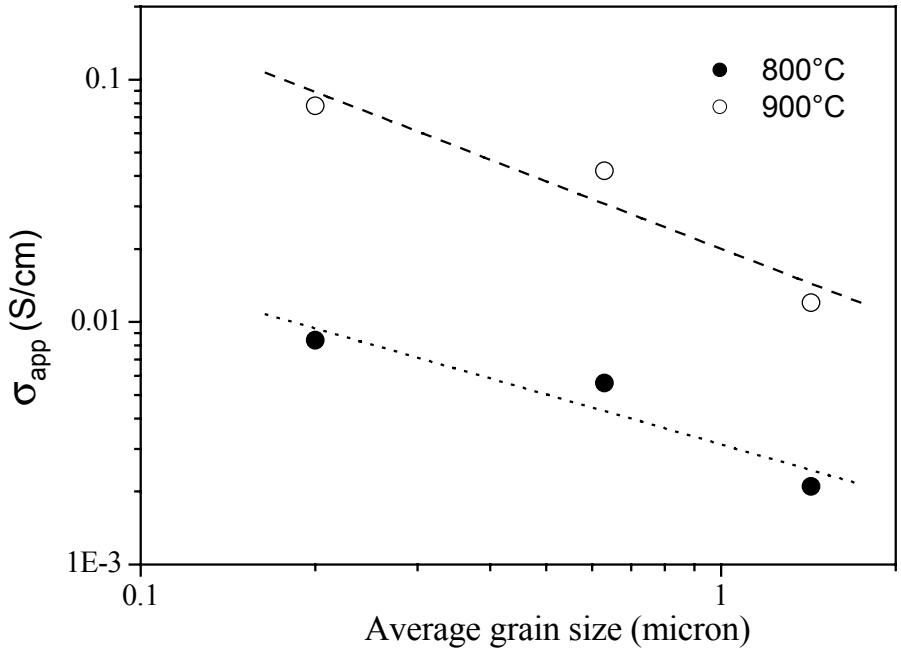
The effect of the bulk microstructure (grain size distribution, grain boundary composition) on the oxygen transport properties of $La_{0.5}Sr_{0.5}FeO_3$ membranes was investigated. For this purpose, samples with different microstructures were prepared by modifying the sintering duration and/or temperature. The average grain sizes, ranging from 0.20 to 1.43 μm, were determined from SEM analysis. The oxygen transport properties of these samples were characterised by permeation measurement as a function of temperature in an air/argon oxygen partial pressure gradient. The fluxes presented a change in the activation energy which was attributed to a change in the rate limiting step, from bulk diffusion at lower temperature (<850°C) to surface limitations at higher temperature (>900°C). Only the transport through the bulk was influenced by the microstructure, with the highest flux for the smallest grains. At 800°C, the fluxes were respectively 0.06, 0.03 and 0.01 μmol/cm^{2}s through ~1 mm thick samples of average grain sizes of 0.20, 0.63 and 1.43 μm, respectively. This would imply that oxygen transport occurs more rapidly along the grain boundaries than through the bulk. Grain and grain boundary compositions were analysed by TEM.



Influence of the average grain size on the apparent ionic conductivity of $La_{0.5}Sr_{0.5}FeO_{3-\delta}$