Lifetime of the internal reference oxygen sensor

The internal reference oxygen sensor (IROS) based on a binary mixture of metal and its stoichiometric oxide is subject to leaks that result in consumption of the binary mixture. An IROS loses the functionality when the binary mixture is exhausted. Among the possible leak sources the electronic leak of electrolyte is usually unavoidable. Thus, evaluation of the electronic conduction of electrolyte is useful for lifetime estimation. In this study the electronic conduction of 8mol% yttria doped zirconia (8YSZ) that is typically used as the electrolyte for solid oxide cells including the IROSes is evaluated, and the depletion period of an IROS based on the binary mixture of Ni/NiO is discussed. The theoretical prediction of the depletion period is verified by experimental results over more than 6600h. Figures that may be used to predict the depletion period are provided for practical cell design. The electronic conduction of electrolyte can be minimized to make the depletion period of an IROS satisfy the target application up to duration of years.
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