Oxygen transport membranes – from material parameters to application oriented devices

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Oxygen transport membranes (OTMs) consists of a dense layer that can conduct both oxide ions and electrons. This allows for a net selective transport of oxygen through the membrane. Different techniques for evaluating membrane materials will be discussed including electrical conductivity relaxation, coulometric titration, electrolyte probe method and thin film methods. The methods are applied to perovskite type materials such as strontium doped lanthanum cobaltite ($La_{1-x}Sr_xCoO_{3-\delta}$, $x = 0.4$ and $x = 0.15$). The derived materials parameters will be used in combination with a model that includes oxygen ion diffusion through the dense membrane, the kinetics of the surface layers and also the gas transport through porous structures. The model will be used in order to define optimal membrane architectures depending on the application. The developed model will be applied both to perovskite and ceria based membranes and the importance of activation layers will be highlighted. Particularly the activation layer for the oxygen reduction needs a very high activity in order not to limit the overall performance of the membrane. Examples of different type activation layers ranging from materials studies on dense thin film perovskites to highly active infiltration layers will be presented.