Characterisation of $(Pr,La)_2NiO_4$ as an oxygen electrodes for reversible SOEC/SOFCs

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The electrolysis of water, driven by surplus energy from renewable sources or nuclear power, allows the efficient and economical production of hydrogen. One method to achieve this is by using solid oxide electrolyser cells (SOECs). In this talk, I will explain the theory of operation of such devices. I will then outline the key advantages of SOECs for hydrogen production, as well as some of the materials challenges to be overcome. In particular, I will emphasise the issues associated with the oxygen electrode, and explain our motivation to develop new materials for use in this part of the cell.

I will then give an overview of a family of promising candidate materials, the first order Ruddlesden-Popper phases with the general formula A_2BO_4 (A = La,Nd,Pr; B = Ni,Co…). These materials have certain transport properties which make them intrinsically more suited to the operation conditions of a SOEC in electrolysis mode.

Finally, since one of the key aspects of our study of these materials will be to understand their surface structure and composition, I will present some preliminary surface characterisation results for the $(Pr,La)_2NiO_4$ subsystem of this family of materials. As most of these results were obtained by Low Energy Ion Scattering, an emerging technique that is not yet widely applied in materials science, I will also provide a brief introduction to the key aspects of this method for surface sensitive chemical analyses.