

# OXIDE ION TRANSPORT AND PHASE STABILITY IN THE EXCESS OXYGEN SCHEELITE PHASES

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Oxide ion conductors for use in electrochemical devices such as solid oxide fuel cells and electrolyzers are typically viewed as requiring three-dimensional isotropic structures that will promote ion transport. The majority of materials considered as electrolytes in devices are based on either the fluorite or perovskite structure types. An essential feature of the materials is that they will accommodate a range of oxygen lattice defects, typically through cation substitution, that introduces vacancies to maintain charge neutrality, and it is the presence and mobility of these defects that produce fast oxide ion conductors. An alternative that has only recently been explored is the potential for oxygen interstitial species to provide fast ion transport pathways. Initially studies focussed on anisotropic materials such as the layered perovskites as potential electrode materials, but more recently our studies have focussed on new electrolyte families.

Here we report our studies on the solid solution series  $\text{LaNb}_{1-x}\text{W}_x\text{O}_{4+d}$  ( $x = 0 - 0.2$ ) which adopts the distorted scheelite type structure. Introducing the W cation induces the ordering of the cation species, and charge

compensation through additional oxygen species. This leads to a series of complex modulated crystal structures, evidenced through electron and neutron diffraction studies. From the preparation of ceramic samples it has been possible to demonstrate that these superstructured phases are indeed fast oxide ion conductors, Fig 1, and that there are three-dimensional pathways through the structure. Additionally, these electrolytes have been demonstrated to functional effectively in electrolysis mode and thus offer considerable potential for future development.

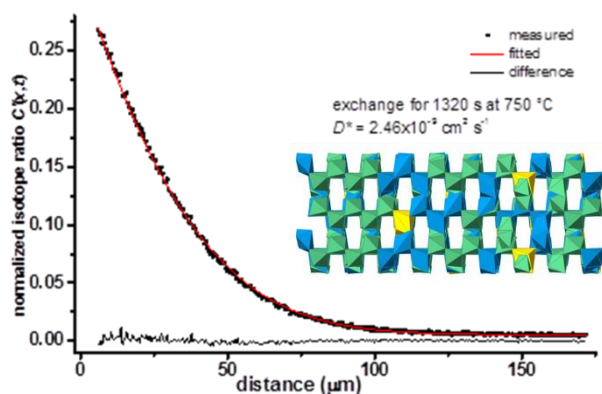


Figure 1 - Oxygen diffusion profile of  $\text{La}(\text{Nb}, \text{W})\text{O}_{4+d}$  electrolyte. Inset shows pathways through the structure