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Neutron and synchrotron characterisation techniques for hydrogen fuel cell materials

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Hydrogen fuel cells and other renewable energy technologies have specific materials and functional needs which can be more fully understood using neutron and synchrotron characterisation techniques. In this presentation, a materials which has applications in proton exchange membranes is studied with a variety to techniques to develop a comprehensive understanding of the functional-structural relationship. The materials used here is phosphotungstic acid (HPWA) stabilised in an 'inert' mesoporous silica host material. This aim of this research is to develop an understanding of the interaction between the HPWA and the silica and whether different structures or surface chemistries have advantageous or detrimental effects.
Two silica symmetries used were Ia$\bar{3}$d (face centred cubic bi-continuous) and P6mm (2D hexagonal with cylindrical pores) which were vacuum impregnated with solutions of HPWA in a range of concentrations. The resulting powder samples were then analysed using small angle x-ray scattering (SAXS), inductively coupled plasma emissions spectroscopy (ICP-OES), nitrogen gas adsorption/desorption, near edge X-ray absorption fine structure (NEXAFS/X-ray absorption near edge structure/XANES) of the O and Si k-edges, Fourier transform infra-red spectroscopy (FTIR), Raman spectroscopy, and then formed into a disk using polyethylene as the binder for electrical impedance spectroscopy (EIS).
The insights gained from this systematic study indicate that the surface chemistry of the silica host has a significant effect on the performance, uptake and interactions with the HPWA anions, where lower concentrations of HPWA result in stronger host:HPWA interactions but lower conductivity

Level of Expertise

Experienced Researcher

Presenter Gender

Woman

Pronouns

She/Her

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Do you wish to take part in the Student Poster Slam

Condition of submission

Yes

Primary author(s) : LAMB, Krystina (ANSTO)

Co-author(s) : KIRBY, Nigel (Australian Synchrotron); Prof. BARTLETT, John (University of Western Sydney); PETERSON, Vanessa (ANSTO); APPADOO, Dom (Australian Synchrotron); JIANG, San Ping (Curtin University); DE MARCO, Roland (University of the Sunshine Coast)

Presenter(s) : LAMB, Krystina (ANSTO)

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