Presentation 7 – Session 3

Neutron Scattering for Industrial Materials

Prof Vanessa Peterson

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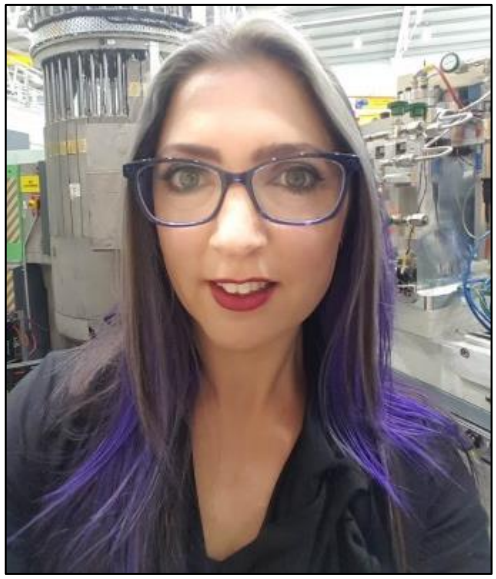
Biography



Vanessa specializes in the characterization of the atomic-scale structure and dynamics of functional materials with the aim of understanding the origin of material properties and behavior, particularly using time-resolved measurements under non-equilibrium conditions.

Vanessa began her nuclear career using neutron scattering at the now decommissioned High Flux Australian Reactor during her PhD in 2000, where she used neutron powder diffraction measurements to understand the composition of cement. Upon the completion of her PhD and a short placement at the University of Technology, Sydney, she moved to the National Institute of Standards and Technology (NIST) Center for Neutron Research (NCNR) in the USA. At the NCNR Vanessa continued her research into cement using quasi-elastic neutron scattering measurements to understand the mechanism of incorporation of water during cement setting, supported by the US Federal Highways Administration. During her placement at the NCNR Vanessa began studying other functional materials, notably solid porous sorbents for the separation and storage of energy relevant gases such as hydrogen and methane, applying neutron powder diffraction to understand the mechanism for the incorporation and release of target guest molecules.

In 2006 Vanessa relocated back to Australia, working at the University of Sydney on solid porous sorbent systems using neutron scattering until 2007 where she gained a position commissioning the two neutron powder diffractometers at the new Open Pool Australian Light-water (OPAL) facility, which she now co-operates as an instrument scientist. In 2010 Vanessa established a research project that became the "Functional Materials for Energy Systems and Devices" project that she leads today, examining functional materials used predominantly for energy storage and delivery. In 2010 Vanessa was promoted to Principal Research Scientist, in 2011 was a Finalist in the Eureka People's Choice Awards, and in 2013 she was awarded a Young Tall Poppy Award from the NSW Australian Institute of Policy and Science. In 2016 she gained an Honorary Professorship with the Institute of Superconductivity and Electronic

Materials at the University of Wollongong. In 2017 Vanessa was awarded the Sandy Mathieson Medal for “distinguished contributions to science involving X-ray, neutron or electron diffraction and/or imaging” by the Society for Crystallographers in Australia and New Zealand.

Vanessa is a Director-at-Large and Indian-Rim Region Chair of the not-for-profit International Centre for Diffraction Data (USA), a member of the International Union of Crystallography Commission on Neutron Scattering, as well as current Vice and past President of the Australian X-ray Analytical Association. She has co-authored more than 160 research publications gaining over 5000 citations and has a h index of 39.

Abstract

Functional materials are central to many technologically important devices and systems. Such materials are often multifunctional and highly responsive. Developing experimental approaches that specifically target functional materials is essential to obtaining a mechanistic understanding of function that leads directly to their advancement. This is particularly relevant given the increasing power and speed of characterization instrumentation, allowing real-time and non-equilibrium measurement of the material during operation to be made. Neutron scattering is a broad range of characterization techniques that allow the atomic and molecular scale structure and dynamics of materials to be understood. Importantly, the attributes of neutrons give a unique perspective of this detail, which is unavailable to X-ray methods. This presentation will highlight studies using neutron scattering to understand the functionality of industrially-relevant materials. Examples of neutron studies of materials for application in technologies including batteries and pressure sensing devices will be given.