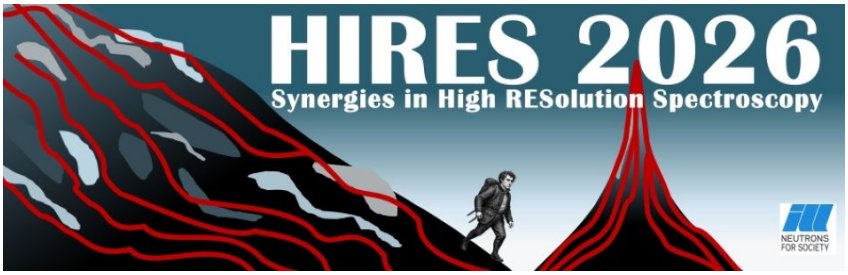

Contribution ID: **77** Type: **Poster**

QENS Linking Microstructure and Transport in PEM Fuel Cell Electrodes

Understanding mass transport in proton exchange membrane (PEM) fuel-cell catalyst layers requires direct links between microstructure, microscopic dynamics, and macroscopic performance. In these electrodes, the relative spatial distribution of water and ionomer within a complex carbon pore network critically governs water management, proton transport, and durability, yet the microscopic origin of these effects remains unclear. Here we investigate catalyst layers with systematically varied pore architectures, ranging from disordered carbon networks to ordered mesoporous and nanotube-based structures. Small-angle neutron scattering is used to quantify mesoscale morphology and phase organization, providing insight into pore ordering, connectivity, and the relative distribution of water, ionomer, and carbon. Quasi-elastic neutron scattering probes water and proton dynamics over relevant length and time scales, enabling separation of long-range transport, confined diffusion, and localized proton-related motions within hydrated ionomer environments. By correlating structural descriptors from SANS with microscopic transport processes from QENS and linking them to electrochemical performance measurements, this study establishes a direct structure–dynamics–performance relationship. The results aim to identify key microstructural parameters controlling coupled water and proton transport and to provide physically grounded guidelines for the rational design of high-performance PEM fuel cell catalyst layers.

Session

Materials Science

Primary author: YANG, Yi (Jülich Centre for Neutron Science, Forschungszentrum Jülich)

Co-authors: Dr OHL, Michael (Jülich Centre for Neutron Science, Forschungszentrum Jülich); FÖRSTER, Stephan (Forschungszentrum Jülich); Mr ZHANG, Yunpeng (Jülich Centre for Neutron Science, Forschungszentrum Jülich)

Presenter: YANG, Yi (Jülich Centre for Neutron Science, Forschungszentrum Jülich)

Session Classification: Materials Science