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Chemical and elemental material analysis of low temperature fuel cells and electrolyzers

Polymer electrolyte membrane (PEM) fuel cells are an emerging technology for clean energy production. To improve the efficiency and durability of these devices, it is essential to understand the material properties of their components. In this study, we investigate the characterization of PEM fuel cell materials combining Raman spectroscopy and X-ray fluorescence (XRF).

Raman spectroscopy is a powerful tool for the characterization of molecular vibrations and provides information on the chemical composition and structural properties of materials. With Raman spectroscopy the composition and molecular structure of the PEM fuel cell materials, including the polymer electrolyte membrane, catalyst layers and gas diffusion layers can be investigated.

X-ray fluorescence (XRF) is a non-destructive analytical technique used to determine the elemental composition of materials. XRF can be employed to determine the elemental composition of the catalyst layers, gas diffusion layers and bipolar plates of the PEM fuel cell. This information is useful for understanding the performance and degradation mechanisms of the fuel cell materials.

The combination of both non-destructive techniques, Raman spectroscopy and X-ray fluorescence, is particularly powerful. By correlating the results from these methods, we can gain a deeper understanding of the sample being studied. This comprehensive approach allows us to extract more meaningful insights from our analyses.

Overall, here we introduce a workflow for studying the material properties of PEM fuel cells, which can be used to improve their performance and durability. The combination of Raman spectroscopy, XRF and particle size analysis is a powerful approach for the characterization of fuel cell materials and can be applied to other emerging technologies in the energy sector.

Figures

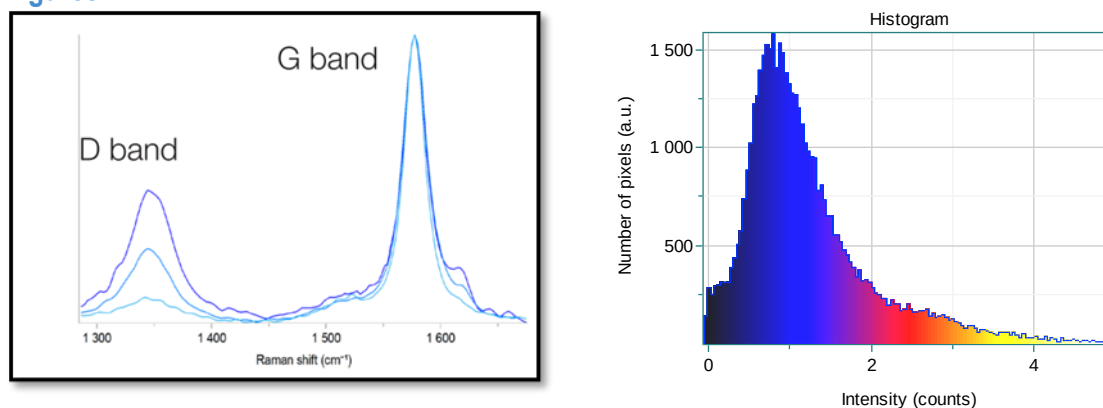


Figure 1: An analysis of carbon support for precious metals. Raman spectra of the carbon support (right) and histogram of the D/G Raman band ratio for the crystallite homogeneity of the carbon support (left).