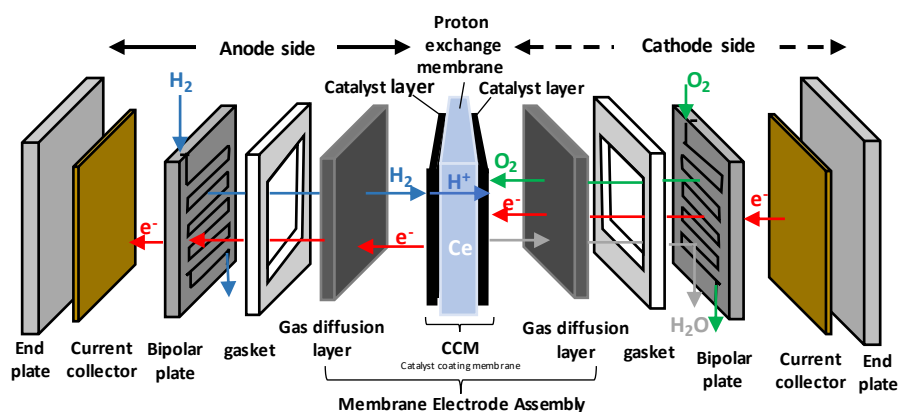


PEMFC material analyses using micro-XRF

What can micro-XRF do for PEMFC?

Proton exchange membrane fuel cell (PEMFC) mainly consists of organic materials such as proton exchange membrane, carbon supports, and carbon sheets. However, it also includes some inorganic elements such as radical quenchers and precious metal catalysts, and the composition and the spatial distribution play important role in the fuel cell property. Micro-XRF allows composition analysis and elemental distribution imaging on PEMFC materials non-destructively.



Applications

Proton exchange membrane

Inorganic radical quencher like Ce is added to the proton exchange membrane, and the spatial homogeneity within the membrane is important to achieve the high durability of PEMFC. Micro-XRF imaging is helpful in understanding the movement of the inorganic radical quencher on a membrane without sample pretreatment like conductive coating.

Catalyst layer

Precious metals like Pt and Pt-alloys are widely used as a catalyst in catalyst layers to boost the electrochemical reactions in PEMFC. Coating of slurry mixed catalysts and carbon materials make the catalyst layer. Elemental imaging by micro-XRF can visualize the homogeneity of the catalyst on the layer non-destructively.

Gas diffusion layer

The gas diffusion layer itself is made from carbon material. However, if it contains unexpected foreign metal particles, such particles cause defects and degradation to PEMFC. Micro-XRF imaging is useful for screening to find foreign metal particles not only on a gas diffusion layer but also in the carbon powder of the sheet material.

Membrane Electrode Assembly

The above layers exist as a sandwich structure called "MEA (Membrane electrode assembly)" in PEMFC. Micro-XRF can be used for 2D imaging of catalyst agglomerates in a MEA sheet after an accelerated stress test, which is reported as a possible root cause of degradation. Micro-XRF is also helpful for 2D imaging of 3d transition metal cations (Fe, Ni, Co, etc) eluted from the alloyed catalyst or bipolar plate material, which may decrease the proton conductivity of the membrane.

Bipolar plate

Bipolar plates of PEMFC are required to be conductive and to have anti-corrosion properties; therefore, some bipolar plates are made of a metallic plate with a metallic coating (ex. Au on SUS316). Thanks to the small spot, micro-XRF can perform elemental analysis on a bipolar plate even with narrow patterns.

What is HORIBA XGT-9000 X-ray analytical Microscope?

