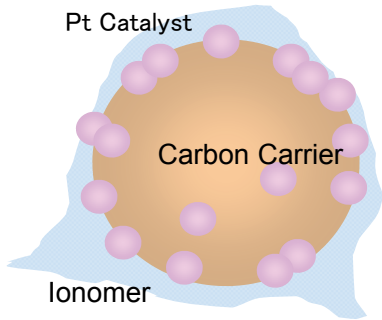


PEFC

3-D Quantitative analysis of Shapes of Catalyst

Estimation for ratio of catalyst which reacts effectively made possible by TEM tomography. In addition, quantitative analysis (ex, coverage of ionomer against carrier) are enabled by detailed analysis for 3-d data.

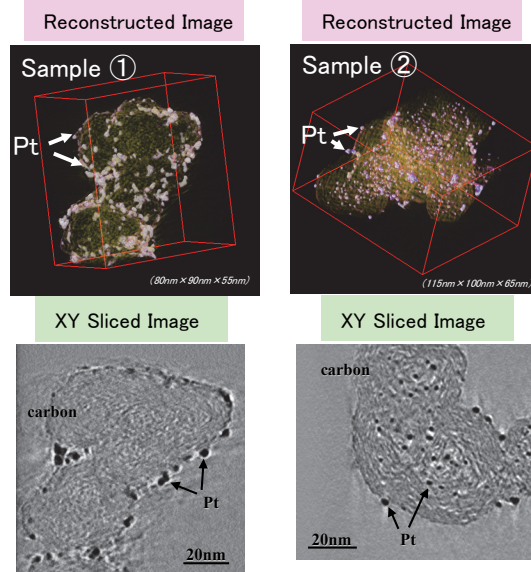
Fuel Cell Catalyst



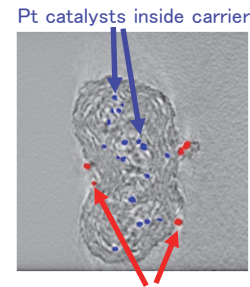
Information to identify the each sample

- Where are Pt catalysts?
- How about shapes of catalysts/
- How about diameter of catalysts, or distribution of diameter?
- What is ratio of embeded particles?
- How about carbon particles?
- How about coverage of ionomers?

Numbering and Identification the Catalysts at the Surface and Inside of Carrier



<Digital Sliced Image of Sample ②>



Pt catalysts outside carrier

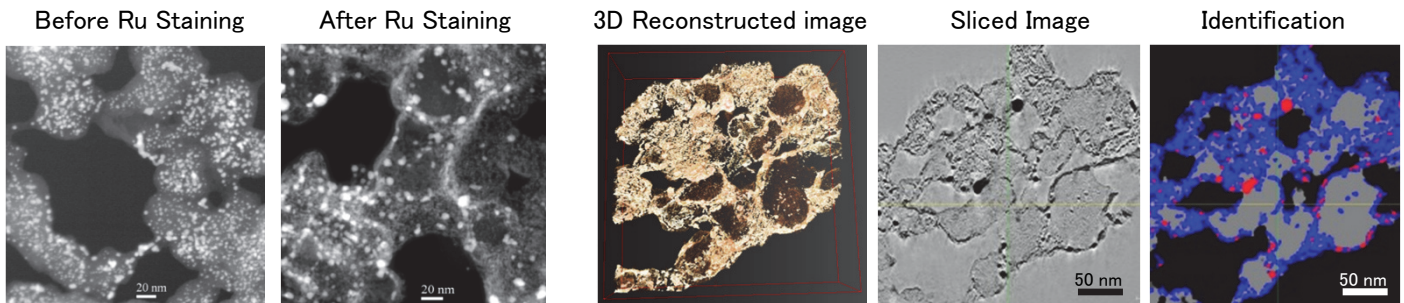
Total number of Pt catalysts: 1202

Number of Pt catalysts outside carrier: 246

Ratio of catalysts outside Carrier
20 (%)

Pt catalyst are observed inside carrier for Sample ②

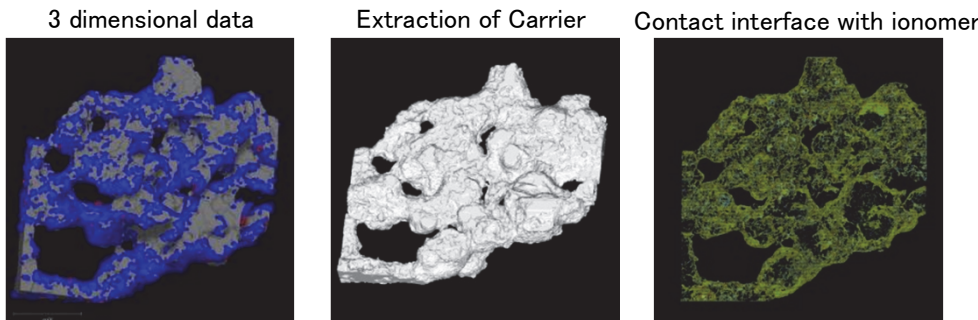
3-D observation of Ionomer Morphology by TEM Tomography and Examples of Quantitative Analysis



Selective contrast acquisition for ionomer

Box size: 305 × 305 × 90 (nm)

- Carbon (Gray)
- Ionomer (Blue)
- Pt catalyst (Red)



- Compositional volume ratio
Carbon = 77 (%)
Ionomer = 14 (%)
Pt Catalysts = 9 (%)
- Surface Area of C = 3.4×10^5 (nm²)
- Contact interface with Ionomer = 1.9×10^5 (nm²)
- Coverage of Ionomer = 56 (%)

Quantitative analysis of reconstructed 3-D data acquired by TEM Tomography make possible to determine the physical parameters about catalysts for Fuel Cell

※A part of these results are supported by NEDO "Reducing Platinum for PEFC"