Activity and Degradation of Carbon Supported Oxynitrides Containing Ultra-low Pt Concentration as Cathode Catalyst for Proton Exchange Membrane Fuel Cells

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Background

- Cost-effective catalysts with superior stability are required for the massive application of PEMFC.

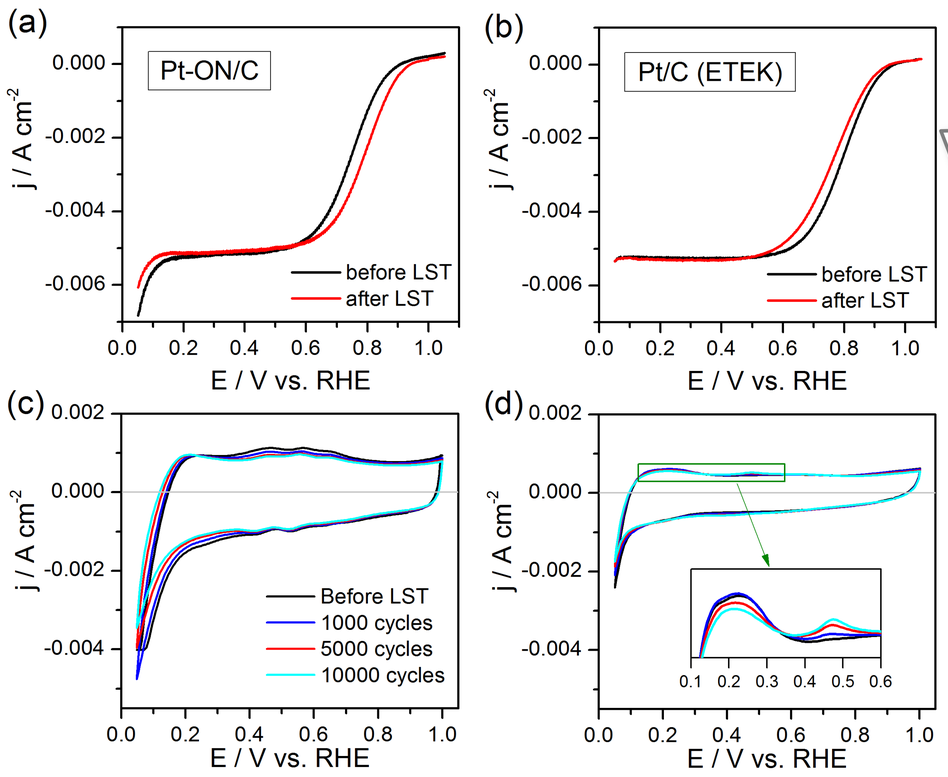
Materials

- Pt-ON/C: 2 wt% Pt + 80 wt% C; ON, $Co_{0.4}Mo_{0.5}O_xN_y$;
  Pt/C (ETEK): 2 wt% Pt/C by mixing with Vulcan XC–72.

Accelerated Stress Test (AST) Protocols

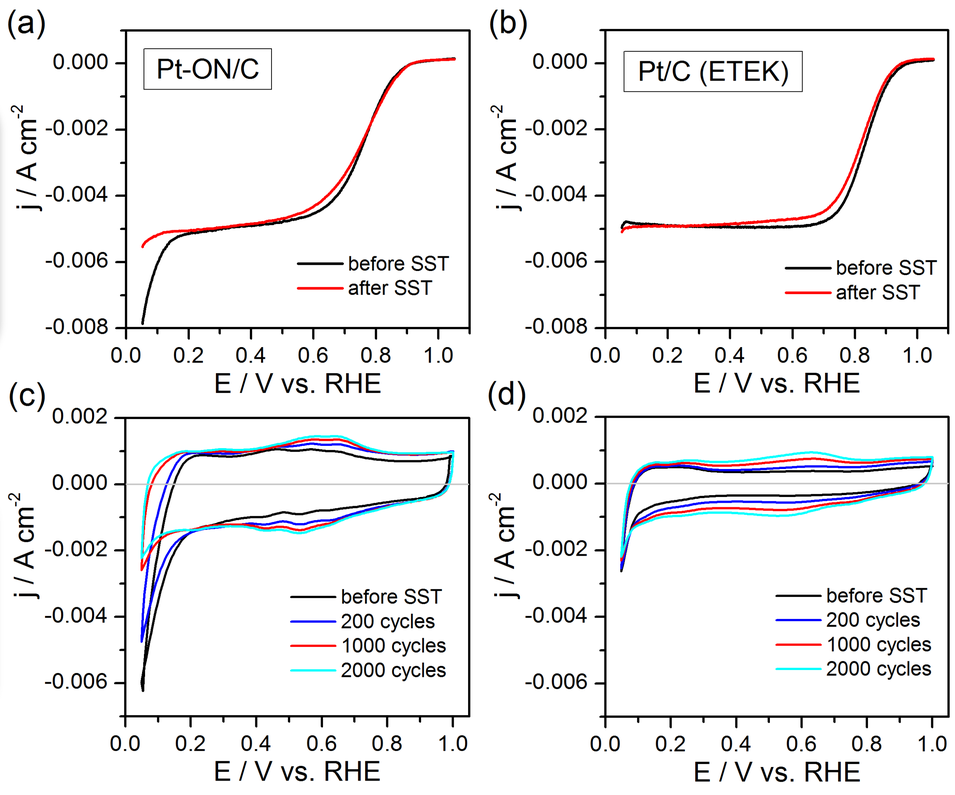
- Lifetime Stability Test (LST):
  10000 cycles of CV, 0.6 V – 1.0 V vs. RHE, 50 mV s^{-1}
- Start-up Stability Test (SST):
  2000 cycles of CV, 0.6 V – 1.4 V vs. RHE, 50 mV s^{-1}

LST protocol



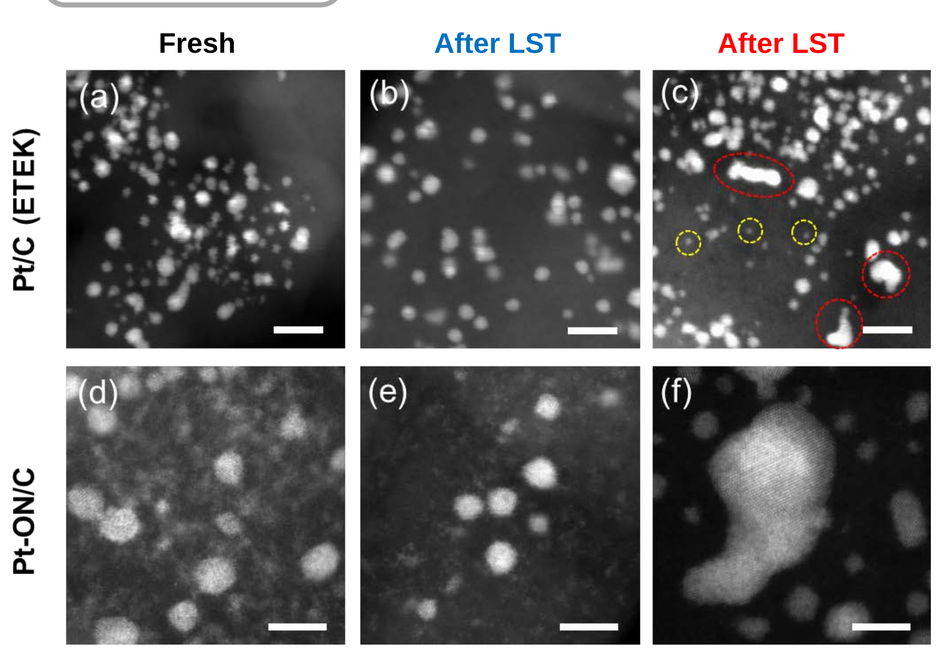
The activity of Pt-ON/C is improved after LST due to the Mo dissolution, while Pt/C (ETEK) clearly degraded.

SST protocol



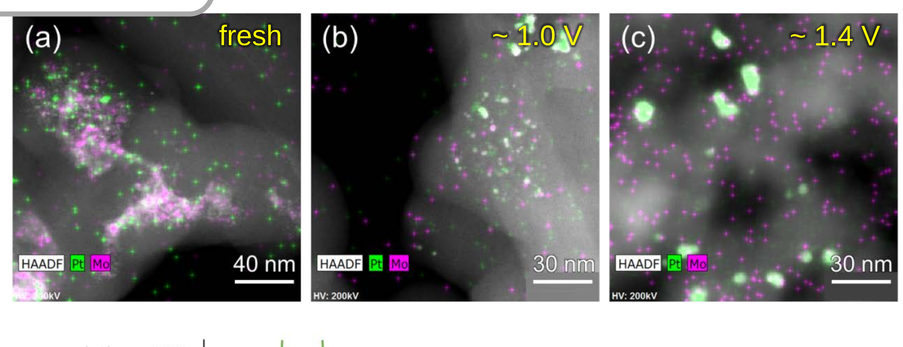
After SST, both catalysts lost the activity owing to Pt growth and carbon corrosion.

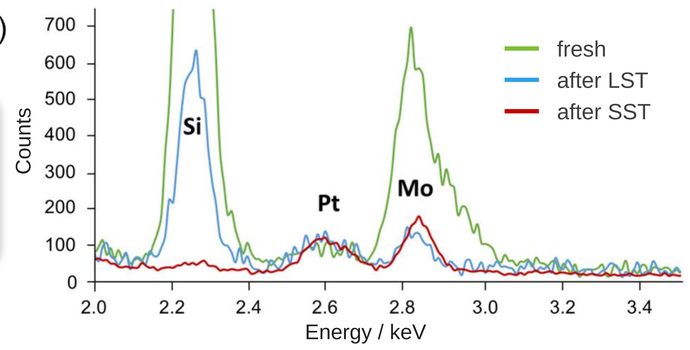
Pt growth



Pt growth is strongly potential dependent, and is only dominant for high potentials (up to 1.4 V).

Mo dissolution





Mo dissolution is observed in the sample of Pt-ON/C during the degradation test for all potentials.

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