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Reactivity Imaging of Platinum-Based Fuel Cell Catalysts

The carbon monoxide (CO) poison, present in the hydrogen fuel used in fuel cells, is there either as a byproduct from upstream reforming or as a partial oxidation product formed during the oxidation of liquid fuels. In PEM fuel cells, the CO adsorbs strongly to active catalytic sites in the Pt-based (anode) catalyst and decreases its reactivity. Therefore, anode catalyst materials with higher CO tolerance need to be identified. Combinational methods can identify suitable materials quickly, but new and rapid screening tools for characterising the materials would help towards their successful application in fuel cell catalysis.

Now, scientists from the University of Virginia, U.S.A., have demonstrated the use of the scanning electrochemical microscope (SECM) for the quantitative screening of combinatorial samples of PtRu and PtRuMo electrocatalysts in liquid systems (H_2SO_4), in the absence and presence of CO monolayers, using reactivity imaging (S. Jayaraman and A. C. Hillier, *J. Phys. Chem. B*, 2003, **107**, (22), 5221–5230).

Catalyst activity was characterised as a function of composition and electrode potential by measuring the activity of the catalyst surface toward the hydrogen (H) oxidation reaction, via tip–sample feedback. The SECM was able to decouple the H oxidation activity and poison (CO) tolerance of the catalysts. Both the onset of CO oxidation and the rate of H oxidation could be determined. PtRu electrodes oxidised H in the presence of CO at 0.35 V below that of pure Pt, which shows that Ru can dissociate H_2O at lower potentials than Pt. Electrodes with Mo improved the onset potential by an additional 0.2 V.