Designing a Better Catalyst for Solar Hydrogen Production

Scientific Achievement

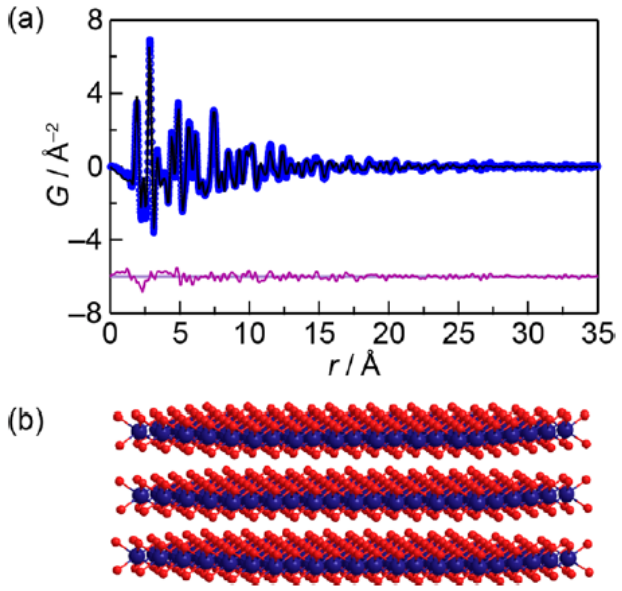
Correlated nanoscale structure with activity for a cobalt-based thin-film catalyst for water splitting powered by sunlight, a sustainable way to produce hydrogen fuel

Significance and Impact

Results advance the development of cobalt thin-film catalysts, bringing scientists a step closer to designing an ideal catalyst for solar water splitting

Research Details

- Film samples were created via electrodeposition using an aqueous cobalt solution mixed with either a phosphate or borate electrolyte to investigate electrolyte effect on structure
- As determined by x-ray pair-distribution analysis, borate films (CoB_i) were more ordered than phosphate (CoP_i) films, with cobalt-oxygen clusters 3 to 4 nanometers in size, stacked three layers deep
- With increasing film thickness, CoB_i films were more catalytically active than the CoP_i films, suggesting film thickness produces an increase in surface area



(a) Fit of a pair-distribution function model (black line) to diffraction data (blue circles) for CoB_1 films packed into polyimide capillaries. Purple line is the difference between them. (b) A ball-and-stick representation of the nanoscale clusters within the CoB_i film (red spheres are oxygen, blue spheres are cobalt).

Work was performed at Brookhaven National Laboratory on the NSLS X7B beamline.

CL Farrow, DK Bediako, Y Surendranath, DG Nocera, SJL Billinge, *J. Am. Chem. Soc.*, 2013, 135, 6403-6406