# Cobalt catalysts for simple water splitting

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(PhysOrg.com) -- Researchers from UC Davis and the Massachusetts Institute of Technology are studying how a simple cobalt catalyst can split water molecules. Such inexpensive catalysts could one day be used to convert sunlight into fuel that can run domestic fuel cells.

In 2008, MIT chemists, led by Professor Dan Nocera, reported that a simple cobalt catalyst could split water at neutral pH to produce oxygen, protons and electrons. The catalyst actually seems to assemble itself over several hours as an electric current is applied, and then begins to bubble oxygen.

"This got a lot of attention from the chemistry community, but no one knew how it worked," said R. David Britt, professor of chemistry at UC Davis.

Britt's lab is working with Nocera's group to use a technique called electron paramagnetic resonance to study the chemical state of cobalt atoms in the catalyst. They found that as more water is split, the proportion of cobalt (IV) increases and the proportion of cobalt (II) decreases. The work opens the door to further studies on these catalysts, the authors write.

Ultimately, catalysts based on relatively abundant elements like cobalt, as opposed to platinum or gold, could make it economical to convert electricity from solar panels or other renewable sources into hydrogen fuel for storage or use. The protons and electrons produced from splitting water would be used in the next step of the process to make

hydrogen.

Electron paramagnetic resonance is a technique similar to the nuclear magnetic resonance used in medical imaging. Britt's lab uses it to study catalysts that split water, including both artificial catalysts and those used by plants in photosynthesis.

"Plants figured this out a couple of billion years ago," Britt said.

A paper describing the work is published online this month by the Journal of the American Chemical Society. Other authors on the paper are graduate student J. Gregory McAlpin, postdoctoral researcher Troy Stich and chemistry professor William Casey, all at UC Davis; and at MIT, graduate student Yogesh Surendranath and postdoctoral researchers Mircea Dinca and Sebastian Stoian.

Provided by UC Davis