SEMINAR

Research Talks from the Resnick Fellows

RESNICKINSTITUTE
science + energy + sustainability

Bryan
Hunter
Resnick Graduate Research Fellow

Splitting Water with Iron for Solar Fuel

Our ability to utilize sustainable resources will be critical in meeting the ever-increasing global energy demand in an eco-friendly manner. The most reliable and available source of sustainable energy is the sun. As a consequence, we must find a way to convert solar energy into storable, transportable fuels. Earth-abundant, efficient, and robust water oxidation catalysts need to be rationally designed based on their catalytic mechanisms.

We recently reported [NiFe]-LDH (layered double hydroxide) nanocatalyst materials that are highly active for water oxidation. We have employed novel in-situ spectroelectrochemistry techniques to identify short-lived catalytic intermediates in nonaqueous media. In particular, we find strong evidence for an iron(VI) oxo that likely plays a role in water oxidation.

Based on the proposed structures of these trapped intermediates, we have developed new catalytic reaction schemes for the [NiFe]-LDH material. In the Looking forward, we hope to utilize this scalable, earth-abundant material for other important transformations, such as the sustainable oxidation of hydrocarbons.

Zhu
Liu PhD
Resnick Postdoctoral Scholar

Revisiting Anthropogenic Carbon Emissions

Anthropogenic carbon emissions come mainly from fossil fuel combustion and cement production process are generally considered to be precisely estimated with limited uncertainty. However, rapid emission growth from emerging economies has introduced new errors in global carbon emission estimations. We implemented in situ measurements and a bottom up investigation of the carbon emissions in China, and our new results show the emissions could be 15% lower than previously estimated, with considerable uncertainty.
This results in 5% less human induced carbon emissions than found in the current literature.
We also observed the carbon uptake effect by cement materials, and quantified the global carbon uptake by cement carbonation. The results show that during 1930-2010, the carbon uptake of cement materials is globally equivalent to about half of the total emissions that are produced during cement production. Our results contribute to the understanding of human impact on global carbon cycles.

3:00 to 4:00 pm | Thursday, 4/20/17
Guggenheim 133 | Lees-Kubota Lecture Hall
Caltech Campus | resnick.caltech.edu

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