Herzliche Einladung zum

Karlsruher
Werkstoffkolloquium
im Sommersemester 2021

Prof. Dr. Christina Scheu
Max-Planck-Institut für Eisenforschung GmbH,
Düsseldorf

Hematite for light induced water splitting –
improving efficiency by tuning distribution of
Sn dopants at the atomic scale

Diskussionsleitung: Prof. Dr. C. Kirchlechner

Dienstag, 15. Juni 2021, 16:00 Uhr, per Zoom:

https://kit-lecture.zoom.us/j/66319826053?pwd=b2t2dlhCdVNUYlpYMzd6TjJIRi9QUT09
Meeting-ID: 663 1982 6053
Kenncode: 092057

Karlsruher Institut für Technologie (KIT), Institut für Angewandte Materialien (IAM),
IAM-Geschäftsstelle, Haid-und-Neu-Str. 7, D-76131 Karlsruhe, Tel. (0721) 608-47912
Light induced water splitting is one way to convert solar energy and store them in hydrogen. This is important for a hydrogen economy to power cars and trucks by fuel cells. Hematite (α-Fe₂O₃) has been investigated for several decades as a photoanode material for water splitting. The absorption in the visible regime is excellent. However, the separation and the transfer of photogenerated charge carriers have low efficiencies, which can be improved by doping, e.g. with Sn. In our work we analyzed in depth the distribution of Sn in ultrathin Fe₂O₃ layers (thickness less than 20 nm) at the atomic scale by various transmission electron microscopy techniques combined with atom probe tomography. Submonolayer coverage of Sn at the surface passivated recombination sites, leading to more efficient hole transfer. When Sn was distributed over several atomic layers on the top, an additional boost in charge separation was achieved due to formation of a local electrical field. For higher amount of Sn, we were able to detect Sn segregation at the grain boundaries, which degrades the crystallinity of Fe₂O₃ and hence the overall performance.

The authors would like to thank the colleagues and co-workers who contributed to this work and the German Research Foundation (DFG) for financial support within the Priority Programme SPP 1613.