

Doktorandenklausur**Projekt: ESF-Nachwuchsforschergruppe „ENano“****SAB-Projektnummer: 100087859****Institut für Werkstoffwissenschaft, Lehrstuhl für Materialwissenschaft und Nanotechnik****Teilnehmer: Dr. Jürgen Gluch****Titel:**

Formation of oxide structures during cyclic redox reaction of iron nano powders

Abstract:

This study is focused on the steam-iron-process for hydrogen storage: $3 \text{ Fe} + 4 \text{ H}_2\text{O} \leftrightarrow \text{Fe}_3\text{O}_4 + 4 \text{ H}_2$. Since the early use of the steam-iron-process a crucial disadvantage is the decrease of storage capacity after repeated storage cycles. The oxidation of nanosized pure iron powder at temperatures up to 750 K in a wet atmosphere results in a complex growth pattern of oxides, which was previously reported for stainless steel [1]. A multi-layer oxide develops at elevated temperatures. This oxide layer exhibits complex structures and microstructures. In tomographic x-ray reconstructions this oxide appears to form a closed skin around the powder agglomerate particles and thus decreases the reactivity during repeated cycles of the redox reaction. This oxide skin is up to 250 nm thick and it is covered with whisker and platelet like features growing at random over the surface. These platelets seem to be hexagonal in shape. To investigate the growth mechanism and possible routes for prevention of oxide skin formation we continue TEM characterisation.

[1] R.L. Higginson and G. Green, Corrosion Science 53 (2011) p.1690-1693

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