Decomposition kinetics of expanded austenite with high nitrogen contents

This paper addresses the decomposition kinetics of synthesized homogeneous expanded austenite formed by gaseous nitriding of stainless steel AISI 304L and AISI 316L with nitrogen contents up to 38 at.% nitrogen. Isochronal annealing experiments were carried out in both inert (N2) and reducing (H2) atmospheres. Differential thermal analysis (DTA) and thermogravimetry were applied for identification of the decomposition reactions and X-ray diffraction analysis was applied for phase analysis. CrN precipitated upon annealing; the activation energies are 187 kJ/mol and 128 kJ/mol for AISI 316L and AISI 304L, respectively. Isothermal stability plots for expanded austenite developed from AISI 304L and AISI 316 were obtained.

Diffusional behavior of nanoscale lead inclusions in crystalline aluminum

TEM observations on the behavior of facet junctions in interfaces and inclusions
A nanotheory of the intense slip localization causing metal fatigue

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On the kinetics of the initial oxidation of iron and iron nitride
The initial oxidation of alfa-Fe and epsilon Fe2N1-x was investigated. Prior to oxidation the sample surfaces were either sputter cleaned with Ar+ ions or sputter cleaned followed by annealing. It was shown that the sputter cleaning pretreatment of epsilon Fe2N1-x led to a reduction of the N concentration in the surface region; subsequent annealing at 573 K led to restoration of the N concentration. Oxidation in pure O2 (generally pH2O2 1•10 4 Pa) was performed at temperatures ranging from 300 K to 600 K. The oxidised samples were investigated with X-ray photoelectron spectroscopy (XPS), ellipsometry and high-resolution transmission electron microscopy (HREM). The oxidation kinetics, as determined with ellipsometry, were described theoretically with the model due to Fromhold and Cook, adopting time-dependent work functions of the metal-oxide and oxide-oxygen interfaces. The calculated evolution of the work functions of alfa-Fe could be related to the change of the oxide film composition, as determined with XPS: it evolved with increasing film thickness from approximately FeO to a composition close to Fe3O4. Upon oxidation of epsilon Fe2N1-x, the nitrogen atoms accumulated underneath the oxide film. For sputter-cleaned + annealed epsilon Fe2N1-x this lead to a nitrogen concentration larger than the maximum solubility of nitrogen in epsilon Fe2N1-x. The excess nitrogen at the metal-oxide interface, which is negatively charged as was indicated by the corresponding XPS N 1s peak, lead to a lower initial oxidation rate of sputter cleaned + annealed epsilon Fe2N1-x than that of alfa-Fe and sputter cleaned epsilon Fe2N1-x. Upon prolonged oxidation the oxidation rate of sputter cleaned + annealed epsilon Fe2N1-x was found to exceed the oxidation rate of sputter cleaned epsilon Fe2N1-x. This was related to the crystallographic constitution of the oxide, as determined with HREM. It was shown that the oxide film on sputter cleaned epsilon Fe2N1-x consisted of only Fe3O4, whereas the oxide film on sputter cleaned + annealed epsilon Fe2N1-x additionally contained Fe1-dO.

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Nucleation of iron nitrides during gaseous nitriding of iron; Effect of a preoxidation treatment

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The nucleation of iron nitrides during gaseous nitriding has been investigated using light microscopy and X-ray diffraction. Initially, the nucleation of gamma'-Fe₄N₁₋ₓ on a pure iron surface starts at grain boundaries meeting the surface, from where the nitride grains grow laterally into the iron grains. On prolonged nitriding, immediate nucleation at the surface of iron grains becomes possible. Calculated incubation times for the nucleation of gamma'-Fe₄N₁₋ₓ during nitriding are generally longer than those observed experimentally in the present work. The incubation time is reduced dramatically after oxidation of the iron surface prior to nitriding. Furthermore, a more uniform distribution of iron-nitride nuclei over the surface is obtained after preoxidation. The enhanced nucleation of iron nitrides on oxidised iron is discussed in terms of the kinetics of the surface reactions, and the development of a metastable precursor for nitride formation.

Nucleation of iron nitrides during gaseous nitriding of iron; the effect of a preoxidation treatment

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On the possible importance of mechanical twinning for the development of the brass-type rolling texture and final comment on the above remarks by T. Leffers

Comment to paper by W. Heye and G. Wassermann: Die Entstehung der Walztexturen der kubisch flächenzentrierten Metalle durch Gleitung, mechanische Zwillingbildung und die Bildung beschränkter Fasertexturen II
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