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EBSD studies on phase transformation of ferrite to nickel free high nitrogen austenite by solution nitriding

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Solution nitriding is one of the cost-effective process and a novel heat treatment for producing nickel free high nitrogen austenitic stainless steels. For the purpose of fabricating these advanced austenitic stainless steels, it is necessary to obtain fundamental information on the ferrite to austenite phase transformation mechanism. In this study, the phase transformation of ferrite to nickel free high nitrogen austenite by solution nitriding was investigated using optical microscopy, X-ray diffraction (XRD) and electron back scattering diffraction (EBSD). Solution nitriding was carried out on a ferritic Fe-22.7Cr-2.4Mo stainless steel plates at 1200°C for 1 and 3 h under nitrogen gas atmosphere of 0.25 MPa. The results showed that upon nitriding, the austenite phase with acicular morphology nucleated in the near surface areas and grew toward ferritic core. The depth of austenite layer was increased from 150 to 470 µm with increasing nitriding time from 1 to 3 h. The EBSD studies revealed that the austenite phase have Kurdjumove-Sachs (K-S) or Bain orientation relation with respect to the ferrite phase. The misorientation across ferrite/austenite phase boundary did not change by increasing the nitriding time. The austenite/austenite boundaries separated by high-angle grain boundaries with 50.9° misorientation and there is large amount of twins of the type Σ3 with 60° misorientation inside austenite grains.

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In situ phase transformation of colloidal transparent metal oxide nanocrystals

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Controlling the crystal structure of inorganic solid-state compound is essential for manipulating their functional properties. Transparent metal oxides are polymorphic materials that have a range of attractive physical properties, including structural versatility, transparency, n-type conductivity, and photocatalytic activity. The phase change of metal oxides is usually achieved at high temperature or pressure. In this talk, I will review our recent kinetic studies of *in situ* phase transformation of In2O3 nanocrystals from metastable rhombohedral phase to stable cubic phase during their colloidal synthesis. These studies have revealed distinct mechanisms of phase transformation in reduced dimensions (surface and interface nucleation mechanisms), and the role of various parameters in this process. The influence of dopant ions on the stabilization of metastable phases and phase transformation of colloidal nanocrystals will also be discussed. I will conclude this talk by discussing the consequences of the nanocrystal phase on different functional properties, including transparency, plasmonics and light emission.

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