

Microalloying of Fe-Cr by using ultrasonic irradiation

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Abstrak

In this work the formation of Fe-Cr microalloy by ultrasonic irradiation at a frequency of 20 kHz is presented. Two sample series were produced with different ultrasonic irradiation procedures. For the first sample, Fe and Cr powder were each separately brought into the ultrasonic device before they were mixed in 7:1 weight ratio and then together retreated using the ultrasonic method. Secondly, Fe and Cr powder with same weight ratio were mixed and directly ultrasonically irradiated. During the ultrasonic irradiation process both samples were put in a toluene solution of 99%. The formation of the Fe-Cr microstructure in conjunction with ultrasonication time were investigated by using Scanning Electron Microscopy (SEM), X-ray

Diffraction (XRD) and Transmission Electron Microscopy (TEM). After 40 hours of ultrasonic irradiation the particle sizes of the Fe powder of the first samples became significantly smaller; some particles were also fused together. However, with the exception of smaller-sized particles no fused Cr powders can be found even after 63 hours of ultrasonic irradiation. After both experiments Fe and Cr were mixed and again ultrasonically irradiated for 20 hours. Some particles indicated as Fe-Cr alloys containing 24.34 wt.% Fe and 67.43 wt.% Cr were observed.

In the sample produced from the second procedure in which both Fe and Cr powders were irradiated together by an ultrasonic method for 50 hours, some powder particles formed a Fe-Cr microalloy with the composition of 96.27 wt.% Fe and 3.73 wt.% Cr. The XRD analysis revealed that the Fe-Cr alloy from the first samples has a BCC structure with a mass fraction of Fe:Cr:Fe-Cr which is equal to 0.836:0.0294:0.135, while the mass fraction of the Fe-Cr alloy from the second sample series is equal to 0.736:0.0808:0.183, respectively. Analysis of the TEM selected area diffraction patterns (SAED) confirmed that the Fe-Cr microalloy occurred originally from the precursor Fe and Cr particles of size smaller than 2 μm . The Fe-Cr microalloy has been successfully synthesized by using an ultrasonic process.