First Shell Low-Temperature Study Of Zincblende-Type ZnS By EXAFS Technique Using Cumulant Method

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Extended X-ray absorption fine structure (EXAFS) has been measured at the zinc K edge in zinc sulfide (ZnS), in the temperature range of 20 K to 300 K, in order to investigate the local structure and temperature effect in a zincblende-type ZnS compound. The cumulant method is used in this purpose. The temperature dependence of the bond distance and the Debye-Waller factor is exhibited and discussed in terms of anisotropy. It is shown that these characteristics parameters increase with the increase of temperature showing the non negligible thermal effect due to the increase of the relative vibration in parallel and perpendicular directions with respect to the bond direction. An agreement is found with other zincblende structure compounds studied by EXAFS technique. The Einstein frequencies are compared to the vibrational densities of states (VDOS) due to the transverse acoustic mode, longitudinal acoustic and/or optic phonon modes while the force constants have been correlated with the valence force field (VFF) models.

Microstructure and chemical composition effects on hydrogen behavior in rapidly solidified Al-Cr alloys

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This work reports recent advances in characterization of the composition at submicron length scales of Al-based rapidly solidified alloys, which are correlated to their interactions with hydrogen. The hydrogen desorption kinetics and the evolution of the surface and subsurface structure and chemical state of high-purity Al, Al-1.0 at % Cr and Al-3.0 at % Cr alloy have been studied by thermal desorption analysis and scanning photoelectron microscopy. The alloy foil structure consisted of Cr-rich and Cr-depleted surface regions exhibits Cr segregation beneath the surface. The obtained results reveal how inclusions of aluminum oxide species can become very strong hydrogen traps at the highest temperatures of 600-630°C, representing irreversible trapping in Al and its alloy. The effect of strong reversible and irreversible hydrogen traps on hydrogen desorption from aluminum alloys is discussed, suggesting that their direct identification in the microstructure provides further insights into hydrogen embrittlement mechanisms for aluminum materials in energy technologies.