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Study of Defects Introduced by 2 and 9 MeV Electron Irradiation in B2 Type Fe-Al Alloy

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Abstract. It is well known that B2 type Fe-Al intermetallic compound alloy possibly includes more than two types of vacancies basically, that is Fe-vacancy and Al-vacancy. Although MeV ordered electron irradiation produces vacancies and interstitials, the threshold energy of displacement for each elemental atom in intermetallic alloys is not necessarily same. In this study, we performed positron annihilation lifetime and Doppler broadening measurements for different energy of electron irradiated B2 ordered Fe50%Al alloy. Different values of positron annihilation lifetime for 2 and 9 MeV electron irradiation were measured. Also, the Doppler broadening S and W parameters showed different changing trend for different energy of electron irradiation. These results suggest that selective atomic displacement takes place in Fe-Al ordered alloy by electron irradiation with different energies.

Introduction

Fe-Al intermetallic compound alloys have good properties such as specific strength to weight ratio and oxidation resistance and strength in elevated temperature so they are attractive as a material used in high temperature application [1]. It is known that the mechanical properties are strongly affected by point defects such as vacancies and interstitials. Then, many research investigations for defects in ordered Fe-Al alloys have been performed in order to understand the mechanical properties for practical fabrication with heat treatment. In addition, this material shows environmental embrittlement called hydrogen embrittlement [2, 3]. It is thought that hydrogen trapping by vacancy type defect is one of the causes of hydrogen embrittlement [4]. As for the vacancies behavior, there is only a few detailed discussions about vacancy type, that is A-vacancy and B-vacancy in B2 ordered alloys. Fe-Al alloys with B2 structure is composed by two sublattices. In thermal equilibrium state, there exist two types of defect structure ideally, that is vacancy and anti-site defects in this alloy. Moreover, these are classified by Fe-vacancy, Al-vacancy, Al anti-site and Fe anti-site [5]. It is thought that these defects should leads to different properties. Energetic particles irradiation method is the best ways to introduce the point defects especially vacancy type defects. In general, MeV ordered electron can produces single vacancy and interstitial (frenkel pair) into metals. In case of particles irradiation into alloys, the threshold energy of displacement for each elemental atom is not necessarily same. On these points of view, we suppose that the vacancy type in compound alloys is controllable by the changing energy of electron irradiation. Actually, Kosugi et al. reported that type of defects produced by electron irradiation in B2 type Fe-Rh alloy changes with different electron energy [6]. Sattonnay et al. also reported similar changes in Ti-Al intermetallics [7]. So far, many research were carried out for the vacancy behavior in various kind of intermetallics with electron and

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Measuring Lattice Strain in Three Dimensions through Electron Microscopy

Defects exist everywhere in the form of grain boundaries, dislocations, vacancies, and local inclusions, and may have a large impact on macroscopic properties of materials. The works presented during the meeting will be published in an international scientific journal. Finally the thesis presents a detailed structural study of disorders in an aluminosilicate zeolite ITQ-39 by combining HRTEM, RED with sample preparation by ultramicrotomy.

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In biology the method is limited by radiation damage; however by summing many images of identical randomly oriented macromolecules, tomographic density maps can be reconstructed at subnanometre resolution from hydrated proteins which cannot be crystallized e.

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In fact, G-BCS also allows an ILA argument as in the case of D-BCS Chen, 2019. This 3D microscopy method is called electron tomography ET and has been utilized in the fields of materials science and engineering for more than two decades.

Identification of crystal symmetry from noisy diffraction patterns by a shape analysis and deep learning

When the Ni 4Mo ordered phase forms from a Ni—Mo solid solution alloy with a disordered fcc structure, six equivalent orientation variants of the Ni 4Mo phase appear. In this work, using a chain model with a reduced number of degrees of freedom, the behaviour of a CNT bundle under uniaxial lateral compression is investigated.

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