論 文 の 内 容 の 要 旨

論文題目 Investigation of Microstructure Evolutions in 12Cr-ODS Steel under Electron Irradiations

（電子照射下における12Cr-ODS鋼の微細組織変化に関する研究）

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The objective of this study is to investigate the microstructural evolution of Y-Ti-O nanoparticles in ferritic 12Cr-ODS steel under in-situ electron radiation. 2 MeV high voltage electron microscope (HVEM) was used for the direct in-situ observation of microstructural evolution at 723K. The focused beam technique was employed to study the effect of vacancy concentration gradient where the electron beam intensity has a Gaussian distribution. The nanoparticles volumetric change under the focused and the defocused beam conditions were compared throughout the irradiations with the irradiation time step as short as 60 s. Also, for each nanoparticle, both the size and shape evolution were investigated throughout the short-time irradiation steps. Unlike the typically reported monotonic size change of nanoparticles, both rapid growth and shrinkage were observed simultaneously in each irradiation time step. This stochastic behavior of Y-Ti-O nanoparticles at the early irradiation stage is first reported in this paper. The total linear volumetric change of initial to final irradiation is found to be inaccurate to fully describe the microstructural evolution of nanoparticles. The shape evolution was also observed and represented by eccentricity; the nanoparticles were classified by two different size groups and their eccentricity changes were plotted and compared throughout the irradiation. Also, 1.25 MeV HVEM was used for the in-situ microstructural evolution observation of single Y-Ti-O nanoparticle at 573K. From Fast Fourier Transformation (FFT) of the single nanoparticle, diffraction patterns are acquired and two patterns which correspond to the nanoparticle are analyzed. The two detected diffraction patterns could indicate that the nanoparticle is composed of two layers and has shell-like structure.　Areas corresponding to the interface between the nanoparticle and bulk were selected to closely investigate the dislocation movement under the electron irradiation. The change in interplanar distance was found from spacing measurements of lattice fringes.