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Influence of helium diffusion and aggregation on the variety of metal nanostructures under helium plasma irradiation ILSU MUN, Osaka Univ, ATSUSHI ITO, National Institute for Fusion Science, KENZO IBANO, YOSHIO UEDA, HEUN TAE LEE, Osaka Univ, OSAKA UNIV. UEDA LAB TEAM, NATIONAL INSTITUTE FOR FUSION SCIENCE COLLABORATION
— The formation of fiber-like nanostructures on tungsten (W) and molybdenum (Mo), known as fuzz, were observed after helium (He) plasma exposure. These nanostructures have large surface area with complete light absorption. He plasma induced structures appear to be used for various applications, but their formation mechanism has not been understood well. We proposed that the agglomeration and diffusion of He atoms in metal lattice are key phenomena of the fiber-like nanostructure formation. In this study, we have investigated variations of He binding energies between transition metals (W, Mo, tantalum (Ta), niobium (Nb), gold (Au), iridium (Ir) and hafnium (Hf)) with agglomerated He atoms by using first principle calculation based on density functional theory (DFT). As a result, we found a link between fiber-like nanostructure formation tendency and helium binding energy. Furthermore, in order to investigate the influence of the diffusion of He atoms in these metals on the variety of these nanostructures, we develop the simulation code based on a Kinetic Monte Carlo (KMC) method. The microscopic physical properties estimated by DFT has been connected to the macroscopic phenomena, which are observed in the real experimental scale, through the KMC simulation.

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