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Influence of zirconium in Gd_2O_3 film grown on Si(100) and Ge(100)

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We have investigated physical properties of Gd_2O_3 and Zr-incorporated Gd_2O_3 grown on Si(100) and Ge(100) substrate by means of an e-beam evaporation and effusion method. We observed x-ray diffraction (XRD) which influences the crystal structure. X-ray photoelectron spectroscopy (XPS) was employed to investigate change of chemical state and atomic force microscope (AFM) micrograph was used to change of morphology by Zr-incorporation in Gd_2O_3 film. Gadolinium reacted with substrates easily while zirconium inhibited the reaction between films and substrates. The lattice constant of Zr-incorporated Gd_2O_3 film grown on Si(100) decreased due to Zr-incorporation caused by a substitution of zirconium with small ionic radius for gadolinium. In the film grown on Ge(100), the relative intensity of crystal structure have changed as a function of the content of zirconium. The film grown on Ge(100) did not contain uniform surface morphology. Zr-incorporation affected the surface morphology of Gd_2O_3 film and enhanced thermal stability of the film.