§20. Analysis of the Microstructure in the Oxide Double Coating Thin Layer for the Liquid Blanket

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An electrically insulating coating of an oxide ceramics is one of the attractive methods for reducing the magneto hydrodynamic (MHD) pressure drop which is a critical issue for liquid lithium fusion reactor blankets, and a ceramic coating for the inner wall would also be necessary to suppress the hydrogen permeation in a molten salt type blanket systems. [1] Recently, Hishinuma et al. have succeeded techniques for large area coating fabrication of Er_2O_3 layers by using the Metal Organic Chemical Vapor Deposition (MOCVD) process in gas phase [2]. In this study, Er_2O_3 coating layers with buffer layer of Y_2O_3 or CeO_2 to reduce misfit between Er_2O_3 coating layer and a substrate of SUS steel substrate and to increase the total thickness of coated layers were fabricated. Their cross-sectioned TEM samples were fabricated by the focused ion beam (FIB) method to check their interfacial structures and their microstructures by XRD, SEM and TEM.

Fig. 1 shows XRD obtained from 3 samples, which means Er_2O_3/ SUS, Er_2O_3 / Y_2O_3 / SUS and Er_2O_3 / CeO_2 / SUS. samples. The lattice parameters of Er_2O_3 and Y_2O_3 are 1.0548 and 1.0487 nm, and similar to each other. It is difficult to distinguish to 2 phases, however, there are 2 peaks around 48 degree to correspond to 2 phases. Er_2O_3 and CeO_2 phases can be detected by XRD. It is also clear what there are textures of <111> direction of Er_2O_3 on Er_2O_3 / Y_2O_3 / SUS, and <100> direction of Er_2O_3 on Er_2O_3 / CeO_2 / SUS samples.

Fig. 2 shows SEM images of surfaces for Er_2O_3 / Y_2O_3 / SUS and Er_2O_3 / CeO_2 / SUS samples. It shows smooth surface morphology and homogeneous distribution of small crystal grains, although there are small surface reliefs. In the future work, the crystallographic orientation relationship between Er_2O_3, Y_2O_3 / CeO_2 and SUS substrates will be clarified.

[1] B. A. Pint, P. F. Tortorelli, A. Jankowski, J. Hayes, T. Muroga , A. Suzuki , O. I. Yeliseyeva , V. M. Chernov : J. Nucl. Mater, 329-333 (2004) 119-124.
[2] Y. Hishinuma, T. Tanaka, T. Tanaka, T. Nagasaka, Y. Tasaki, A. Sagara, T. Muroga: Fusion Engineering and Design, 86 (2011) 2530-2533.

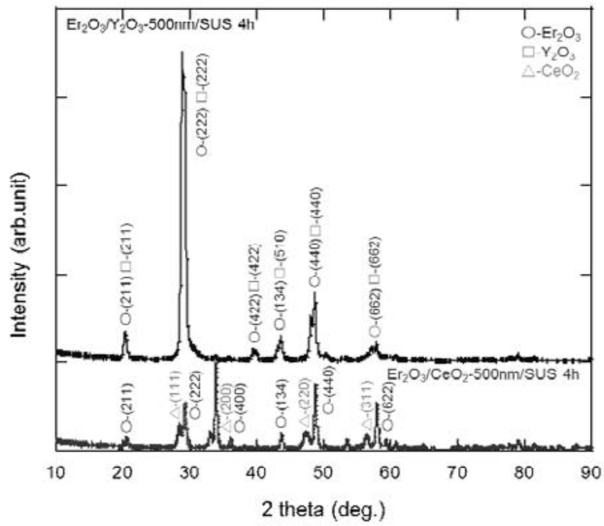

Fig. 1. XRD result for Er_2O_3/ Buffer (Y_2O_3,CeO_2) / SUS sample.

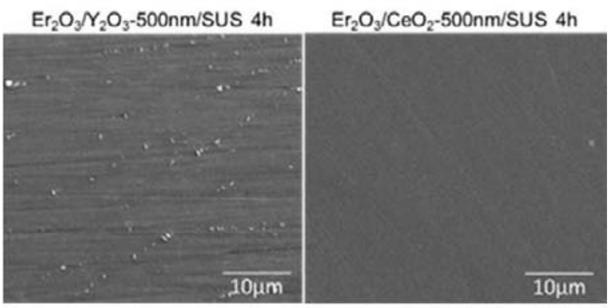

Fig. 2 SEM images of surfaces on Er_2O_3/Buffer (Y_2O_3, CeO_2) / SUS samples. Left: Er_2O_3 / (Y_2O_3) / SUS, Right: Er_2O_3 / (CeO_2) / SUS