



Development of Low Activation Vanadium Alloys for Fusion Reactor

Takuya Nagasaka

National Institute for Fusion Science, Oroshi, Toki 509-5292, Japan

e-mail address: nagasaka@nifs.ac.jp

Low activation vanadium alloys are candidate structural materials for fusion reactors. R&D programs for V-4 mass%Cr-4 mass%Ti alloy fabrication were initiated in the U.S. in the 1990s. Ingots of US832665 (500 kg) and US832864 (1200 kg) were produced in 1994 and 1996, respectively. Fabrication of NIFS-HEAT-1 (30 kg) and NIFS-HEAT-2 (166 kg) were conducted in Japan in 2000 and 2001, respectively. RF-VVC2 (42 kg) was melted in 2000, then RF-VVC3 and several ingots (100~110 kg) were fabricated by 2009 in Russia. SWIP-30 (30 kg) was recently prepared in China in 2010. CEA-J57 heat (30 kg) has been melted under a collaborative program between France and Germany in 2010. These activities promoted researches on fabrication technologies for blanket components, and more recently for structural application in fission reactors (France).

One of the key technologies for successful fabrication is to control interstitial impurity (C, O and N) levels and Ti-CON precipitation in vanadium alloys. The impurity levels in the above ingots ranged from 37-290 mass ppm for C, 148-357 mass ppm for O, and 76-130 mass ppm for N. Research has shown that the distribution of Ti-CON precipitates depends on the impurity level and the processing parameters used in the breakdown of the ingots into plates, and in the following heat treatments¹, welding² and coating³. The impact of these factors on the resulting microstructure and mechanical properties is discussed.

[1]. T. Nagasaka, T. Muroga, K. -i. Fukumoto, H. Watanabe, M. L. Grossbeck, J. M. Chen, *NuclFusion*, **2006**, *46*, 618-625.

[2]. T. Nagasaka, M. L. Grossbeck, T. Muroga, and J. F. King, *FusionTechnol*, **2001**, *39*, 664-668.

[3]. T. Nagasaka, T. Muroga, H. Watanabe, R. Kasada, N. Iwata, and A. Kimura, *JNuclMater*, **2011**, *417*, 306-309.