

§10. Investigation for the Large Ingot
Fabrication of a V-Cr-Ti Alloy

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Vanadium alloys are candidate materials for the FFHR blanket structure because of their low activation characteristics and superior thermo-mechanical properties at high temperatures.

One of the key issues associated with the low activation vanadium alloys is the absence of a large industrial infrastructure. We have started a program of fabricating large (~200 kg) ingot of V-4Cr-4Ti by collaboration with Japanese industries. The planning of the fabrication has been carried out including many scientists of Japanese Universities. The objectives of this program are summarized as follows.

- (1) Feasibility of high purity large heat production by the present industrial basis.
- (2) Fundamental understanding of impurity pick-up during the fabrication.
- (3) Utilization of the resulting ingot for researches which require large

material, such as workability tests, full-size mechanical property tests and welding tests.

N and O are the important impurities which are known to degrade both workability and post-irradiation mechanical properties of vanadium alloys. In this program, transportation of the impurities during each step of the fabrication process was analyzed and the most effective means to reduce the impurity pick-up was identified. The N and O levels of the metal vanadium were reduced to ~100 ppm by modification of the aluminothermic reduction and electron-beam melting processes. Figure 1 summarizes the N and O levels reported so far including both laboratory-scale small melting and large scale melting. The figure demonstrates that the impurity levels of the ingots produced by the present study are much lower than those of other large-scale ingots.

Several alloying techniques were compared from impurity pick-up viewpoints. The vacuum refining and the hydrogen refining have been explored for high-purity alloying. The fabrication is scheduled to be completed in FY99.

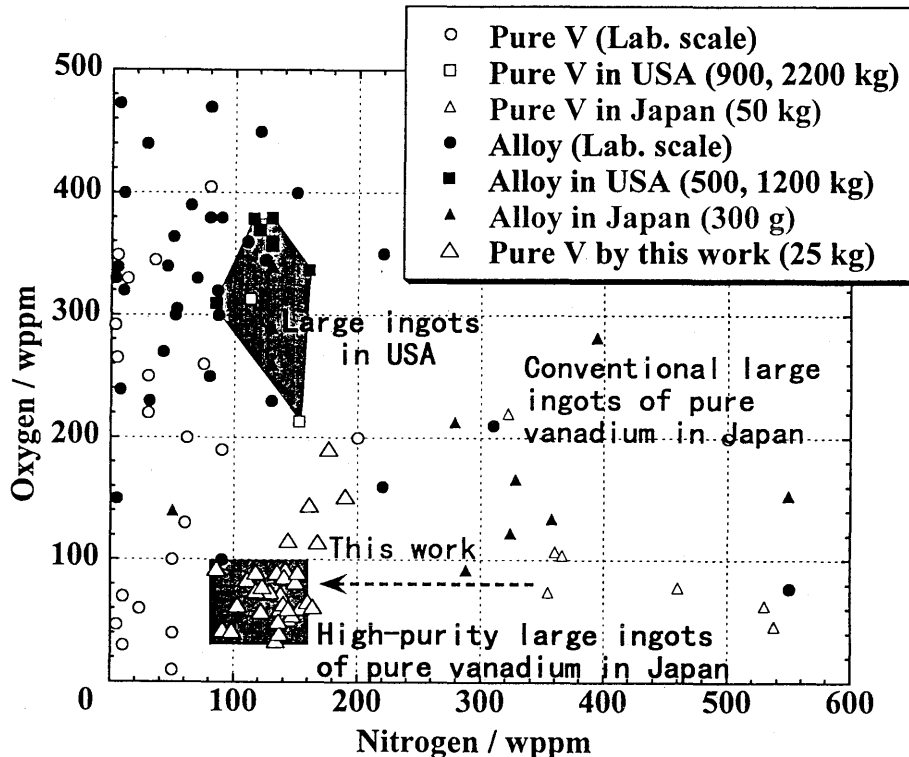


Figure 1 N and O levels of V and V alloys