

PRODUCTION AND FABRICATION OF VANADIUM ALLOYS FOR THE RADIATIVE DIVERTOR PROGRAM OF DIII-D

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V-4Cr-4Ti alloy has been recently selected for use in the manufacture of a portion of the DIII-D Radiative Divertor modification, as part of an overall DIII-D vanadium alloy deployment effort developed by General Atomics (GA) in conjunction with the Argonne and Oak Ridge National Laboratories (ANL and ORNL). The goal of this work is to produce a production-scale heat of the alloy and fabricate it into product forms for the manufacture of a portion of the Radiative Divertor (RD) for the DIII-D tokamak, to develop the fabrication technology for manufacture of the vanadium alloy Radiative Divertor components, and to determine the effects of typical tokamak environments on the behavior of the vanadium alloy. The production of a ~1300-kg heat of V-4Cr-4Ti alloy is currently in progress at Teledyne Wah Chang of Albany, Oregon (TWCA) to provide sufficient material for applicable product forms. Two unalloyed vanadium ingots for the alloy have already been produced by electron beam melting of raw processed vanadium. Chemical compositions of one ingot and a portion of the second were acceptable, and Charpy V-Notch (CVN) impact tests performed on processed ingot samples indicated ductile behavior. Material from these ingots are currently being blended with chromium and titanium additions, and will be vacuum-arc remelted into a V-4Cr-4Ti alloy ingot and converted into product forms suitable for components of the DIII-D RD structure. Several joining methods selected for specific applications in fabrication of the RD components are being investigated, and preliminary trials have been successful in the joining of V-alloy to itself by both resistance and inertial welding processes and to Inconel 625 by inertial welding.