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P4.127 Development of self-passivating W alloy / Eurofer brazed joints

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The development of the future fusion reactor is highly associated to the improvement of the current materials, specially tungsten materials, to withstand the extreme conditions giving inside the reactor vessel during service life. Tungsten has extraordinary physical characteristics as plasma facing materials (high thermal conductivity, sputtering resistance and melting point). However, it has also two main disadvantages: 1) its high brittleness and 2) its high corrosion rate at high temperatures in an oxygen atmosphere. In order to solve the second inconvenient self-passivating materials based on the addition of Cr and Y2O3 particles have been developed to enhance corrosion behavior of the material. These new materials have to be joined to other materials (i.e. Eurofer) in order to conform the plasma facing components. Therefore, joining technologies need to be implemented to meet the requirements of the reactor environment.

The present work proposes a brazing procedure to join a self-passivating tungsten alloy (W-10Cr-0.5Y2O3) with Eurofer. The results indicated the achievement of high quality W-Eurofer joints using 80Cu-20Ti filler material. The resultant microstructure of the braze changed considerably compared to the brazing attempts with pure tungsten, which is associated to the reactive character of chromium. A high interaction between molten filler and W base material has been detected, with preferential grain boundary penetration of Cu-Ti into W alloy.

The mechanical properties of the joints were evaluated by means of microhardness and shear strength tests. The microhardness study of the self-passivating tungsten alloy indicated that the mechanical properties and, therefore, the microstructure of the base material have not been affected by the brazing process because their hardness values measured in the as received conditions have not been modified. Regarding to the strength of the joints, a shear strength of ~ 90 MPa has been obtained, which ensure the operative brazeability and the metallurgical brazeability.

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