

Preliminary Study on Hot Isostatic Pressing Diffusion Bonding for CLAM Steel (P4-I-428)

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China Low Activation Martensitic (CLAM) steel is being developed in ASIPP (Institute of Plasma Physics, Chinese Academy of Sciences) since three years ago. CLAM is selected as the major candidate structure materials for the FDS series design of fusion reactors and for China liquid metal LiPb Test Blanket Module (TBM) for ITER i.e. DFLL-TBM, which are being carried out in ASIPP. Since the hot isostatic pressing (HIP) bonding technique is one of the main candidate bonding techniques for manufacturing of the first wall of a fusion reactor, research of the HIP technique on CLAM/CLAM is greatly needed.

Preliminary HIP diffusion bonding experiments on CLAM steel have been performed. A few machining approaches such as dry-milling, turnery and grinding etc. were used to prepare the sample surfaces and then they were degreased with a mixture of alcohol, ether and acetone in an ultrasonic bath. The samples were joined by HIP diffusion bonding with the compression pressure of 150MPa and the holding time of 2~3 hrs under different temperatures between 950℃ and 1100℃. Different seal techniques of the capsules were studied as well. Then appropriate post heat treatment was done.

Tests on mechanical properties of the joints such as tensile strength and impact toughness have been performed. The preliminary results show that the tensile properties are roughly the same as those of the base material. The absorbed energy of the joints at present is a little low and further research is needed to increase it. Microstructure of the joints was studied by optical microscope, SEM and TEM. Compositions of the defects on the joining line were analyzed by EDS. Through analysis of the results, optimized parameters for HIP are given.