Small scale TBM first wall panel fabrication with CLAM steel by HIP

diffusion bonding

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China Low Activation Martensitic (CLAM) steel, one of the Reduced Activation Ferritic/Martensitic steels (RAFMs), has been being developed in Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP). It is chosen as the primary candidate material in the designs of FDS (Fusion Design Study) series LiPb blankets for fusion reactors and corresponding Dual Functional Lithium Lead (DFLL) Test Blanket Module (TBM) for ITER in China. So the development of the fabrication techniques for DFLL-TBM with CLAM is urgently needed. The Hot Isostatic Pressing (HIP) diffusion bonding is considered as the primary candidate manufacturing technique for the first wall which is one of the key components of TBM.

The fabrication of small-scale first wall panels made in CLAM steel was performed by adopting one-step HIP (Hot Isostatic Pressing) method. By applying the conditions identified in the previous studies (1100°C/150MPa/3h), a panel with several cooling channels has been fabricated. The panels was destructively tested to examine the HIP bonding interface metallurgically and to characterize the microstructure change of the CLAM steel due to the HIP process. The destructive examination has confirmed sound bonding for all of the HIP interfaces and satisfactory dimensional tolerance, and applicability of one-step HIP bonding to this kind of complex component made from CLAM steel has been demonstrated. So fabrication of another larger first wall mock-up is in plan.

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