

R&D on CLAM steel of its large ingot smelting, property test and fabrication of small TBM

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Abstract: With good irradiation swelling resistance, thermo-physical and thermo-mechanical properties, the RAFMs (Reduced Activation Ferritic/Martensitic steels) have been considered as the primary candidate structural materials for the blanket of the first fusion power plant. The China Low Activation Martensitic (CLAM) steel is being developed in ASIPP (Institute of Plasma Physics, Chinese Academy of Sciences) under wide collaboration with many institutes and universities.

Production scale is the key index of CLAM steel for industrialized application. Based on the prophase research of several small heats smelting, a heat of 1.2 ton, named as heat 0912A, was fabricated in 2009, and then hot-forged and rolled in different specifications for property test and research for fabrication technique of TBM. The results of component measurement show that the chemical compositions of HAET 0912A is eligible without composition segregation. The property tests include tensile, Charpy impact and fracture toughness tests. The results of property tests show that the mechanical properties of HEAT 0912A is similar to that of small ingot of CLAM steel.

CLAM steel is chosen as the primary candidate structural material of the LiPb blanket and Dual Functional Lithium Lead TBM (DFLL-TBM) developed in China. The development and test strategy of DFLL-TBM includes three stages: out-of-pile test, test in EAST and test in ITER. The 1/3 size mockup of TBM for out-of-pile test was fabricated in 2010, and the joining techniques of CLAM such as Electron Beam Welding (EBW) and Hot Isostatic Pressing Diffusion Welding (HIP-DW) and the fabrication of rectangular tube with CLAM steel were studied in detail during recent years.

The recent progress of these R&D activities is summarized in this study.

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