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Materials development for ITER shielding and test blanket in China

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ABSTRACT

China is a member of the ITER program and is developing her own materials for its shielding and test blanket modules. The materials include vacuum-hot-pressing (VHP) Be, CuCrZr alloy, 316L(N) and China low activation ferritic/martensitic (CLF-1) steels. Joining technologies including Be/Cu hot isostatic pressing (HIP) and electron beam (EB) weldability of 316L(N) were investigated. Chinese VHP-Be showed good properties, with BeO content and ductility that satisfy the ITER requirements. Be/Cu mock-ups were fabricated for Be qualification tests at simulated ITER vertical displacement event (VDE) and heat flux cycling conditions. Fine microstructure and good mechanical strength of the CuCrZr alloy were achieved by a pre-forging treatment, while the weldability of 316L(N) by EB was demonstrated for welding depths varying from 5 to 80 mm. Fine microstructure, high strength, and good ductility were achieved in CLF-1 steel by an optimized normalizing, tempering and aging procedure.