Overall Development of CLAM Steel for Fusion Application in China

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A program for fusion reactor structural material, i.e. the China Low Activation Martensitic (CLAM) program, supported by the Ministry of Science and Technology of China etc. since 2001, is expected to satisfy the material requirements of test blanket module (TBM) for ITER, China fusion engineering test reactor (CFETR) and fusion demonstration reactor (C-DEMO) in China. The development of CLAM steel is led by the Institute of Nuclear Energy Safety Technology (INEST), Chinese Academy of Sciences (CAS) with participation of more than twenty research units (i.e. institutes, universities and labs etc.) in China. The status and strategy of the CLAM steel project will be reviewed in the presentation.

CLAM steel has been chosen as the structural material in the design of FDS series PbLi blankets for fusion reactors and China fusion engineering test reactor (CFETR) blanket in China. Especially, it has been chosen as the primary candidate structural material for Chinese helium cooled ceramic breeder (HCCB) TBM for ITER by China International Nuclear Fusion Energy Program Execution Center (CNDA). Great achievement has been accomplished in the CLAM project during the past fifteen years, including large scale fabrications, various physical and mechanical properties tests, series of neutron irradiation experiments up to 21dpa, long-term corrosion experiments up to 20,000 hrs, different scaled TBM mockup fabrications and material database development, etc..

To license a pressurized nuclear equipment e.g. the ITER TBM or the blanket for DEMO, it is required to present the design and safety analyses with sufficient data such as the consolidated materials data, design limits and qualified fabrication procedures specifications etc. to the Regulator (ESP/ESPN) and the Agreed Notified Body (ANB) of France or China's Nuclear Safety Agency. A lot of efforts and work are being devoted to the R&D of CLAM steel. The database of CLAM steel shows that most of its properties meet the requirement and application in ITER-TBM.