Contribution ID: **559** Type: **Poster**

Manufacturing Technologies for UHV Compatible 10 MW/m2 High Heat Flux Components for Application in Fusion Devices

Friday, October 26, 2018 2:00 PM (20 minutes)

High heat flux components form the primary interface of thermal management of injectors in the fusion devices. The requirement for such application varies from 1 to 10MW/m2. UHV compatibility is the inherent characteristics of such components also manufacturing processes involves the development of specific material, process qualification of special process like EB welding and component performance validation.
One such component of active thermal management in Neutral Beam injector is Hypervapatron based Heat transfer element (H-T-E) which is designed to absorb heat flux as high as 10MW/m2. The realization route is through prototype and established on one to one model and evaluating their performance. The development route of the H-T-Es represents several important areas like 1) development of precipitation hardened CuCrZr material characterized for its fatigue life (more than 1,00,000 stress controlled cycles), mechanical properties at ambient (UTS > 384 MPa, elongation > 13 %) and at operational temperature i.e. 350⊠C (UTS >263 MPa, Elongation > 14%), restricted chemical composition range of Cr, Zr, Cd and O2 to enhance precipitation effect and weldability of the component 2) similar (CuCrZr to CuCrZr) and dissimilar material (CuCrZr-Ni-SS316L) joining by advanced technology like EB welding in controlled environment to enhance the localized high heat input over a large weld penetration depth with minimal distortion and thereby overcome the effect of thermal diffusion by typical copper during welding 3) validation of these weld joints w.r.t international codes/standards 4) validation of design through performance testing by simulating the operational scenario. Successful realization of this route establishes H-T-Es as main baseline components of High Heat Flux system or Neutral Beam system. Similar application areas can be identified in various fusion devices.
The paper presents the implementation of this realization route of prototype Heat Transfer Elements including the details of assessment carried out w.r.t application.

Country or International Organization

India

Paper Number

FIP/P8-20

Primary author: Mr PATEL, Hiteshkumar Kantilal (ITER India, Institute for Plasma Research)

Co-authors: CHAKRABORTY, Arun Kumar (ITER-India, Institute for Plasma Research); Mr BALASUBRAMANIAN, K (Non Ferrous Material Technology Development Center); Mr PANDA, Nirmal (Non Ferrous Materials Technology Development Center); Mr KANOONGO, Nitin (Non ferrous Materials Technology Development Center)

Presenter: Mr PATEL, Hiteshkumar Kantilal (ITER India, Institute for Plasma Research)

Session Classification: P8 Posters

Track Classification: FIP - Fusion Engineering, Integration and Power Plant Design