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Present Development Status of EUROFER and ODS-EUROFER for Application in Blanket Concepts

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Within the European Union, the two major breeding blanket concepts presently being developed are the Helium Cooled Pebble Bed (HCPB), and the Helium Cooled Lithium Lead (HCLL) blankets. For both concepts, different conceptual designs are being discussed with temperature windows in the range 250-550°C for conservative approaches based on reduced activation ferritic-martensitic (RAFM) steels, and in the range 250-650°C for more advanced versions, taking into account Oxide Dispersion Strengthened (ODS) steels. As a final result of a systematic development of RAFM-steels in Europe, the 9% CrWVTa alloy EUROFER was specified and produced in an industrial scale with a variety of product forms. A large characterisation program is being performed including irradiation in materials test reactors between 60 and 450°C (\leq 15 dpa), and in a fast breeder reactor at 330°C up to 30 dpa. EUROFER is resistant to high temperature ageing, and the existing creep-rupture data (~30,000 h, 450 - 600°C) indicate long-term stability and predictability.

The ODS variant of EUROFER shows superior tensile and creep properties compared to EUROFER. Applying a new production route has diminished the problem of lower ductility and inferior impact properties. Analytical TEM studies, which correlate microstructure and mechanical properties, will be presented. A reliable technique for the joining of ODS and RAFM steels employing diffusion welding was successfully developed.