

EXPERIMENTAL DETERMINATION AND CALPHAD MODELLING OF THE FE-W SYSTEM

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Recent development activities of ferritic/martensitic 12% Cr aim at application of this material in environmentally friendly Ultra Super Critical (USC) Power Plants, operating at 650°C and 30 MPa. In addition, these steels are recognised as a potential alternative for widely used austenitic stainless steels. Critical issues are the improvement of creep resistance as well as of corrosion resistance. The development of new complex materials such as ferritic steels demands well-established thermodynamic and mobility databases.

High melting elements are usually slowly diffusing species. Therefore, it is difficult to obtain equilibrium using standard methods (e.g., annealing and diffusion couples). Consequently, alternative methods have to be devised.

Directional solidification experiments were performed for several Fe-W alloys, starting from 1700°C (in the liquid+bcc field) and cooled to room temperature. Due to the different densities of phases/elements, the resulting microstructure is a very broad snapshot of phase equilibria of the system. On the other hand, the exact temperature of the phase transitions cannot be obtained directly by this method. Slices were then cut from the sample and annealed at different temperatures.

The experimental information obtained, together with available data from the literature, were employed to model the Fe-W binary phase diagram following the Calphad approach.