The electromagnetic phase separation technique in the determination of solid / liquid equilibria in multicomponent systems

The knowledge of liquid/solid equilibria is of particular interest in the development of special materials with high characteristics, or in solidification process applications. The electromagnetic phase separation (EPS) technique, developed at the laboratory a few years ago, constitutes a powerful and viable technique to establish phase relationships in the solid/liquid range of a large variety of metallic systems, by maintaining long time annealing at high temperature, and thus to achieve the constitution of solid and liquid phases in equilibrium at selected temperatures and compositions. The method is appropriate for systems with volatile and reactive components to be studied at relatively high temperature. The EPS technique is of the type similar to those in which use is made of long-term isothermal heat treatment and quenching. However the procedure which involves phase separation before quenching ensures that the high-temperature equilibrated phases are preserved.

Fe-W-C and Fe-Ti-B ternary systems and Al-based systems have been investigated recently with good success to determine equilibria involving a liquid phase. In the case of the Fe-W-C system, the link between DTA- determined temperatures and micrographs is not direct and the settling effect of WC carbides has to be taken into account. The EPS technique allows to determining the equilibrium states involving the liquid phase between 1423 K and 1543 K and to specifying the position of the liq./ WC+gamma and liq./WC+M_6C univariant lines.

The experimental setup is currently under reconstruction in order to have an updated and efficient experimental tool.

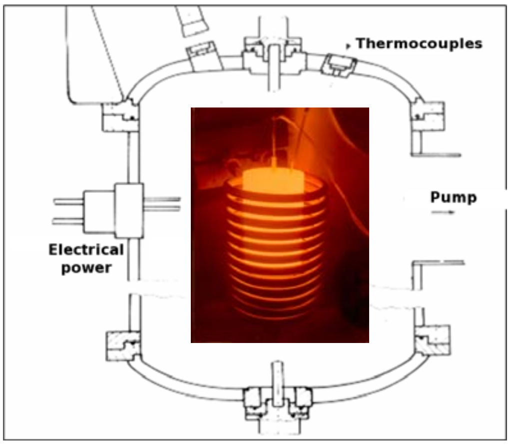

Figure 1. Medium frequency induction furnace (10 kHz) under helium atmosphere

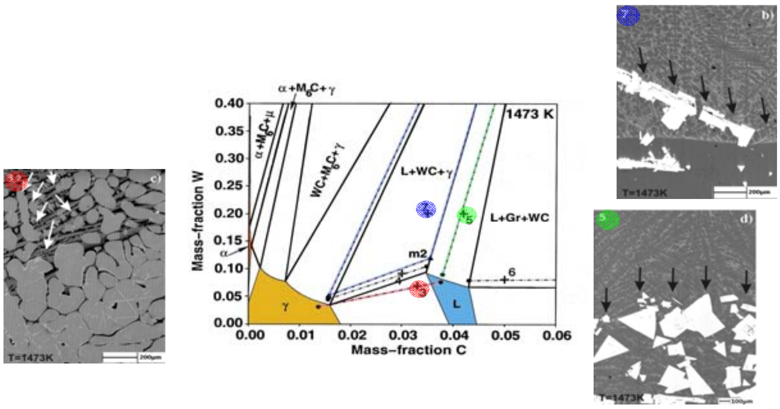

Figure 2. Composition of phases in equilibria corresponding to tie-lines and tie-triangles on the isothermal section at 1473 K of the C-Fe-W system.
The arrows indicate a boundary limiting a liquid area. The coarse solid phases are located below this boundary.

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