Segregation effects and phase developments during solidification of alloy 625

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The solidification behaviour of pure Alloy 625, and Alloy 625 enriched respectively in iron and carbon, was investigated in situ by hot-stage light optical microscopy. Using this technique planar front solidification for distances of several hundred microns was facilitated. After solidification, the material that experienced planar front solidification corresponded accurately to that of dendrites tens of microns in width adopting an equivalent dendrite arm width approach. Eventually, the planar solidification front broke down, where after the residual liquid solidified eutectic-like. This material contained gamma-phase, Laves phase and, if carbon was dissolved in the liquid, niobium rich carbides formed. Molybdenum and niobium showed strong tendencies to segregate. Their segregation was balanced by inverse segregation of nickel and iron. The chromium concentration remained almost constant in gamma in the entire matrix material. Addition of carbon did not cause detectable alterations of the material that experienced planar front solidification. However, it promoted the formation of niobium rich carbides in the material that solidified eutectic-like. Thus, this material differed from that of the pure sample in constitution, and consequently in gamma-phase composition. Niobium rich carbides formed prior to Laves phase; in carbon rich volumes only the carbides form. As compared to the pure sample, the sample enriched in iron had decreased global minimal solute concentration in the material that experienced planar front solidification. However, once the concentrations were corrected with respect to the dilution simply caused by the presence of iron, the solidification behaviour in this material was identical to that of the pure sample. The constitution in the material that solidified eutectic-like was gamma and Laves phase. As compared to the pure sample, the Laves phase was enriched in iron.

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