Product Data Sheet

MCP 124/Metspec 255 Alloy

UPDATED ON 2012-07

TYPICAL USES

A principal use of the alloy is in tube and section bending, for which it is often preferred on very large cross-sections where, unlike the lower temperature alternatives, it need not be quenched to bring it to the best condition for the process; with a melting point above 100^0C, its disadvantage is in requiring special melt out techniques. It finds uses in other mechanical forming operations, such as support material in the forming of copper pipe-fittings.

As a well-defined eutectic, MCP 124 is satisfactory in thermal protection devices, although its yield temperature is strongly influenced by impurities. Other uses tend to be similarly specialized.

PHYSICAL PROPERTIES

MCP 124 is the eutectic of the Bismuth-Lead system. Solidification occurs at 125^0C, but melting behavior is rather more complex and depends on the age and thermal history of the alloy. The system Bi-Pb (fig. 5) shows a peritectic at 32.2% Bismuth, and at Bismuth contents between this value and the eutectic at 55.5% a ß-phase deposits on cooling. The solid solution of Pb in Bi is the y-phase, which is the second component of the eutectic.

In common with all alloys of low melting point, MCP 124 undergoes a slow equilibration after solidification, producing changes in physical properties. It is an alloy particularly sensitive to impurities, quite low levels of which can affect its appearance and properties, including the thermal yield point (and thus its use in thermal protection devices).

Characteristic	Typical Value
Density	10.73 g/cm^3
Brinell Hardness	14 -15
Melting Range	125 °C
Specific heat at 25°C (solid)	0.126 J/g.°C
Specific heat at 120°C (liquid)	0.155 J/g.°C
Enthalpy of fusion	21.2 J/g
Electrical resistivity	98.7 mΩ.cm
Compressive Properties: Proof stress at 2 days and 70 days (0.2% set) (1.0% set)	 22.6 rising to 32.2 MPa 28.4 rising to 38.4 MPa
Tensile Properties: Data at 2 days and 70 days Proof stress 0.2% set Tensile Strength Elongation (% in 5.65√A)	 18.3 rising to 26.5 MPa 31.2 rising to 47.7 MPa 80 falling to 37.5

[1)] The analytical purity is determined by ICP (Inductively Coupled Plasma)

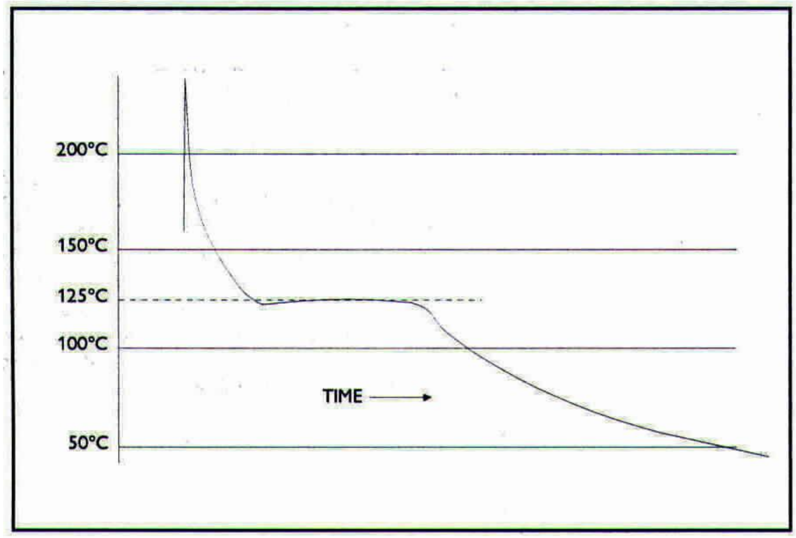

Fig. 1 SOLIDIFICATION

The trace obtained by solidification from a homogeneous melt of a sample of 300g indicates a reasonably precise final arrest at 125^{0}C; although this is preceded by slow variation that suggests that the composition is not accurately eutectic. The curve may be compared with the behavior in melting of newly solidified and mature samples (fig. 2).

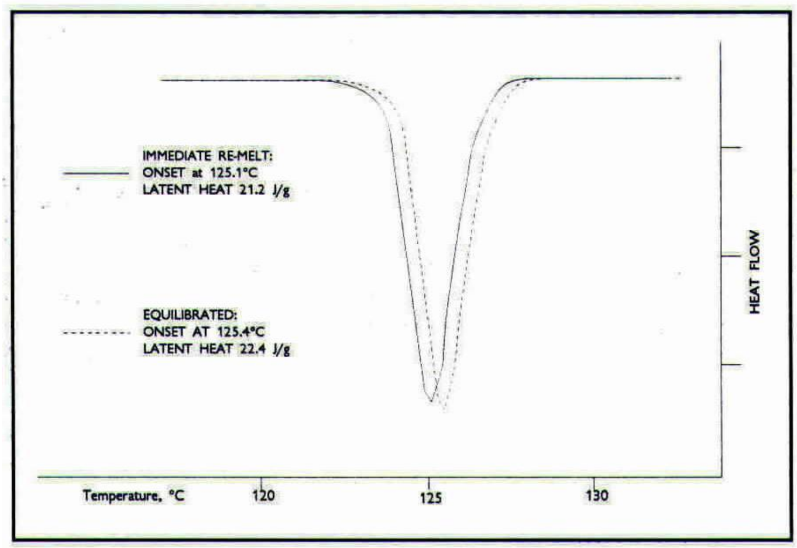

Fig. 2 MELTING

The structural changes that take place after solidification are made apparent by the technique of differential scanning calorimetry (DSC). The behaviour of matured alloy is here compared with that of newly solidified specimen.

The onset temperature for melting, like the latent heat of fusion, is found to have increased in very old specimens, suggesting that mature alloy is needed in thermal protection devices.

While the curves for these extremes of treatment are reproducible, there are differences in melting behaviour between specimens of different ages (or which have had different thermal conditioning). The curve remains stable after the specimen has reached the ‘equilibrated’ condition.

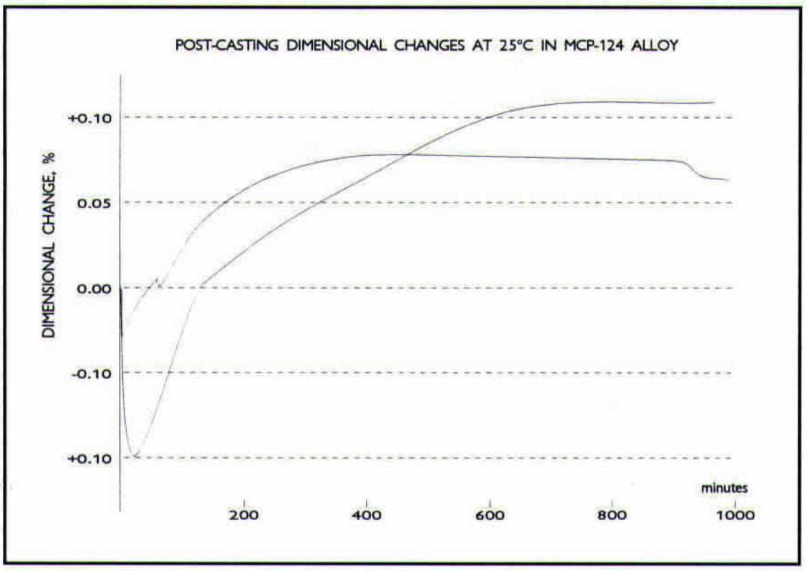

Fig. 3 GROWTH & SHRINKAGE

The linear dimensional changes after casting are sensitive to the size and shape of the specimen, which affect the rate of cooling after solidification and, in consequence, equilibration of the internal structure. The ultimate change is the same for all fully mature specimens. Curve A is for a 10mm square bar, 250mm in length, which shows a nett growth of 0.11% after about 16 hours (rising to 0.25% after 6 months). The lower curve B is for a faster quenched, small specimen of 5 x 5 x 2mm.

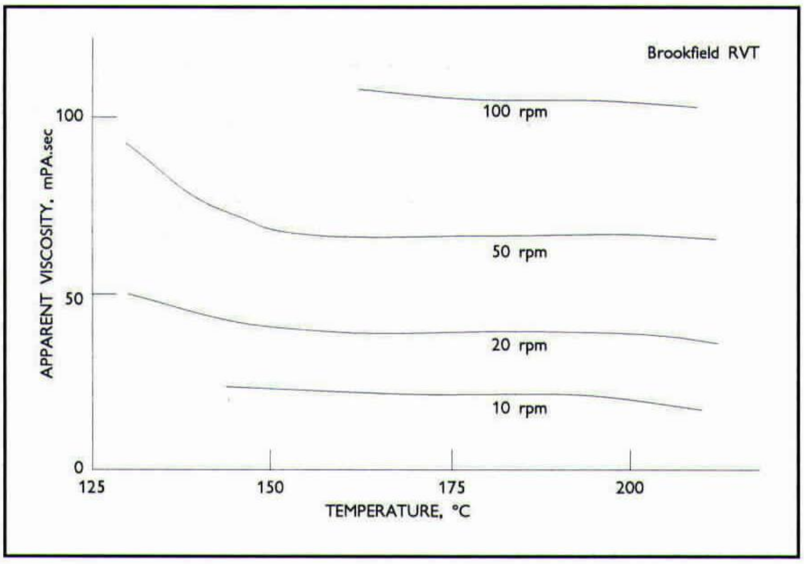

Fig. 4 VISCOSITY

Like that of most fusible alloys, the viscosity of MCP 79 is quite low, at a few mPa.s. High surface tension may cause practical measurements to suggest non-Newtonian behavior. The values indicated in the diagram were obtained by means of a Brookfield RVT viscometer, using 3 liters of liquid alloy depth being roughly equal to diameter. The figure illustrates changes apparent under conditions such as might be encountered in practical use. Viscosity is, in fact so low that it is rarely a serious consideration in designing systems in which large quantities of alloy are circulated.

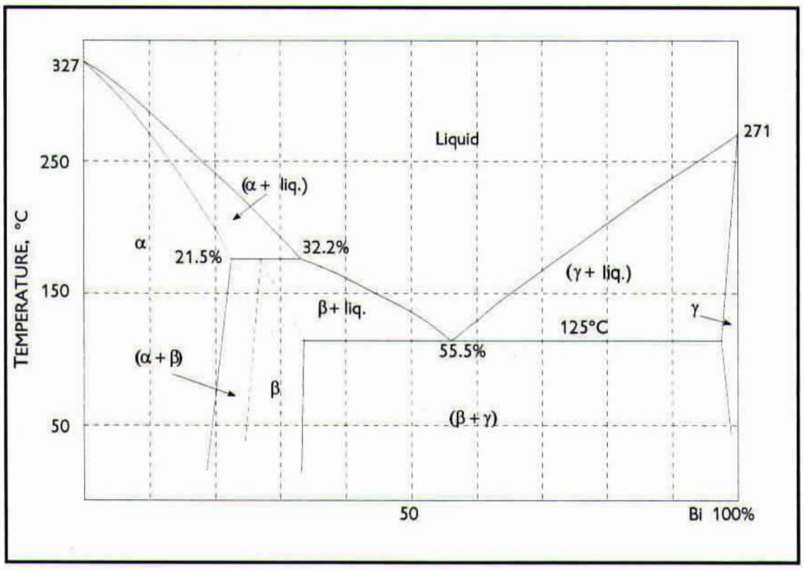

Fig. 5 THE BI-PB PHASE DIAGRAM

The diagram is based on published diagrams (e.g. M. Hansen & K. Anderko, 'Constitution of Binary Alloys'; C.J. Smithells, "Metals Reference Book"), and unpublished 5N Plus Inc. data.

The eutectic temperature of 125^{0}C is well defined. It corresponds remarkably well with the (yield) temperature at which this alloy and adjacent compositions suddenly lose mechanical strength.

STORAGE AND USE

Store products in their original packaging.
Wear protective equipment recommended by the Safety Data Sheet.