Product Data Sheet

MCP 70/Metspec 158 Alloy

UPDATED ON 2012-07

TYPICAL USES

A traditional and still important use of the alloy is in tube and section bending, for which it needs to be quenched to bring it to the best condition for process; with a melting point well below 100^{0}C, its advantage over alternative alloys lies in the simple, low cost melt out techniques that can be used.

Although not a true eutectic, MCP 70 is satisfactory for thermal protection devices designed to yield at 70^{0}C. Other uses include work holding and supporting, blocking of glass lenses, sheet forming dies and fusible cores.

PHYSICAL PROPERTIES

MCP 70 was long thought to be the eutectic of the bismuth-tin-lead-cadmium system. However, a weak first arrest in solidification at 74^{0}C shows this not to be so: Investigations by the "last to freeze" technique suggest that the eutectic is of significantly different proportions. Melting behavior is quite complex and depends *inter alia* on the age and thermal history of the alloy.

In common with all alloys of low melting point, MCP 70 undergoes equilibration after solidification. The equilibration process gives rise to slow dimensional changes, which occur at rates dependent on the immediate post solidification treatment. Natural cooling is characterized by a sudden recalescence at about 55^{0}C, which produces changes in physical properties that must be delayed by quenching before use in bending work.

Characteristic	Typical Value
Density	9.67 g/cm^3
Brinell Hardness	13 -14.5
Melting Range	70-76°C
Specific heat at 25°C (solid)	0.146 J/g.°C
Specific heat at 150°C (liquid)	0.184 J/g.°C
Enthalpy of fusion	32.9 J/g
Electrical resistivity	48 mΩ.cm
Compressive Properties: Proof stress at 2 days and 70 days (0.2% set) (1.0% set)	 10.4 rising to 17.9 MPa 14.3 rising to 23.0 MPa
Tensile Properties: Data at 2 days and 70 days Proof stress 0.2% set Tensile Strength Elongation (% in 5.65√A)	 6.9 rising to 11.4 MPa 18.4 rising to 26.1 MPa 205 falling to 120

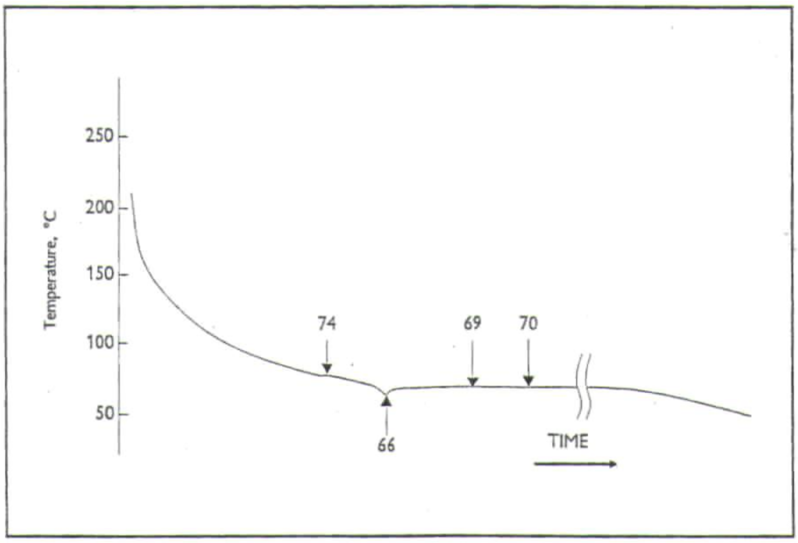

Fig. 1 SOLIDIFICATION

The trace obtained by solidification from a homogeneous melt of a sample of 300g indicates a weak first arrest at about 74^{0}C, followed by a reasonably precise plateau at 70^{0}C.

There is strong post solidification evidence of further reaction while solidification is being completed. This may be compared with the behavior in melting of newly solidified and mature samples (fig. 2).

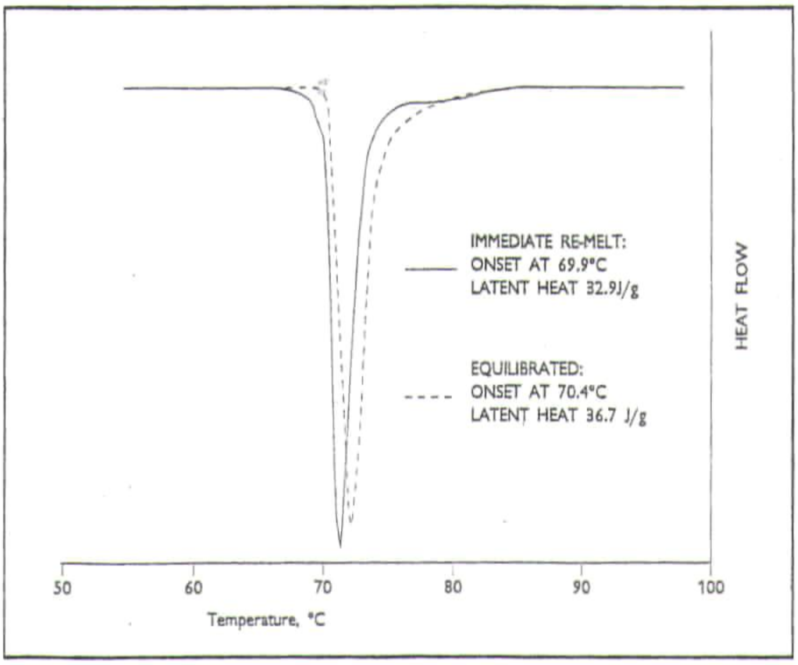

Fig. 2 MELTING

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

The onset temperature for melting, like the latent heat of fusion, is found to have altered in older specimens, while the liquidus appears to be above the 74^{0}C suggested by the solidification cure of fig. 1.

While the curves for these extremes of treatment are reproducible, there are substantial 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. Attention needs to be given to this point when the alloy is used in thermal safety devices.

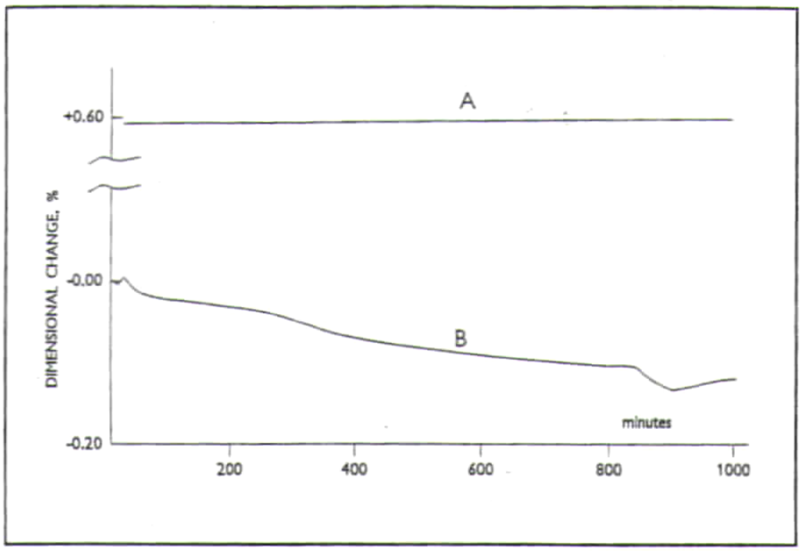

Fig. 3 GROWTH & SHRINKAGE

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.

Curve A is for a 10mm square bar, 250mm in length, promptly quenched after solidification, which shows a net growth of 0.6% after about one hour, then to remain essentially stable indefinitely. The lower curve B is for a faster quenched, small specimen of 5 x 5 x 2mm. Such differences ultimately disappear between fully mature specimens.

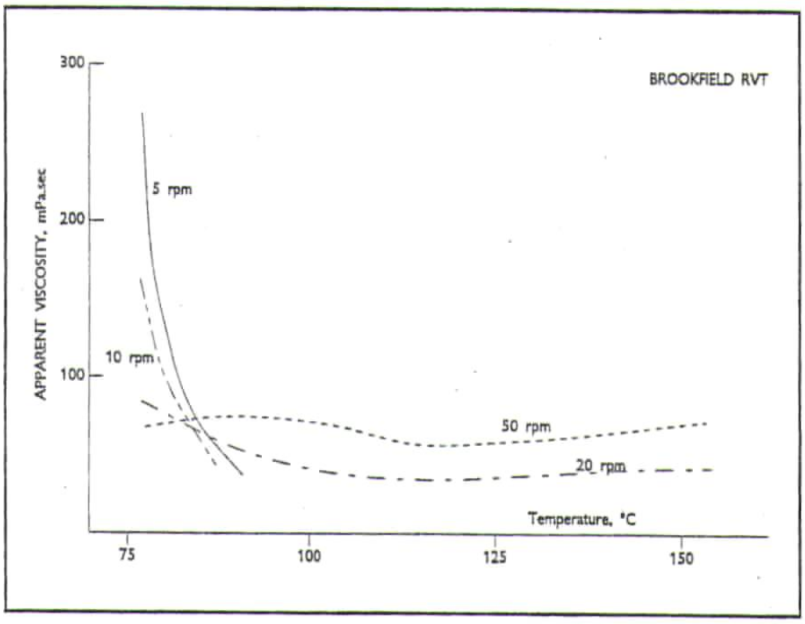

Fig. 4 VISCOSITY

Like that of most fusible alloys, the viscosity of MCP 70 is quite low. Slightly above the liquidus at about 74^{0}C it is a few mPa.s; however; the high surface tension causes practical measurements to suggest non-Newtonian behavior. Viscosity is, in fact, so low that it is rarely a serious consideration in designing systems in which large quantities of alloy are circulated.

The values indicated in the diagram were obtained by means of a Brookfield RVT viscometer, using 3 liters of liquid alloy in a cylindrical container with alloy depth being roughly equal to the diameter. The figure indicates changes apparent under conditions such as might be encountered in practical use. The apparently complex pattern, changing from shear thinning at low shear rates to shear thickening, is compatible with the implication of fig. 2 that the true liquidus is above the observed 74^{0}C.

STORAGE AND USE

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