Product Data Sheet

MCP 47/Metspec 117 Alloy

UPDATED ON 2012-07

TYPICAL USES

MCP 47/Metspec 117 is employed for work holding where the lowest temperature possible is needed. Use of the alloy is mainly in the optical industry, depending almost entirely on its low melting point and consequent tendency not to distort the glass or plastic which it supports.

Other uses include low temperature soldering and jointing, while its melting characteristics (including low specific heat and latent heat of fusion) make it suitable for use in the thermal safety devices.

PHYSICAL PROPERTIES

MCP 47/Metspec 117 has the lowest melting point of any in the standard MCP range. The alloy appears to approximate the eutectic of the bismuth–lead–tin–cadmium–indium system, a conclusion supported by investigations using the 'last to freeze' technique. Melting occurs within a narrow band of temperature, but the behaviour is complex and depends inter alia on the age and thermal history (and thus the degree of equilibration) of the alloy (see fig. 2).

In common with all alloys of low melting point, MCP 47/Metspec 117 undergoes equilibration after solidification. The equilibration process gives rise to slow dimensional changes, which occur at rates dependent on both the immediate post solidification treatment and the size and shape of the piece. Natural cooling in large specimens is characterised by a long, ill-defined arrest at 40 – 30^{0}C, directly indicating changes in physical properties.

Characteristic	Typical Value
Density	9.36g/cm^3
Brinell Hardness	14.5 to 16.5
Melting Point	47°C
Specific heat at 25°C	0163J/g.°C
Specific heat at 275°C	0.197J/g.°C
Enthalpy of fusion	24.9/g
Thermal Conductivity	0.145 J/sec.cm.°C

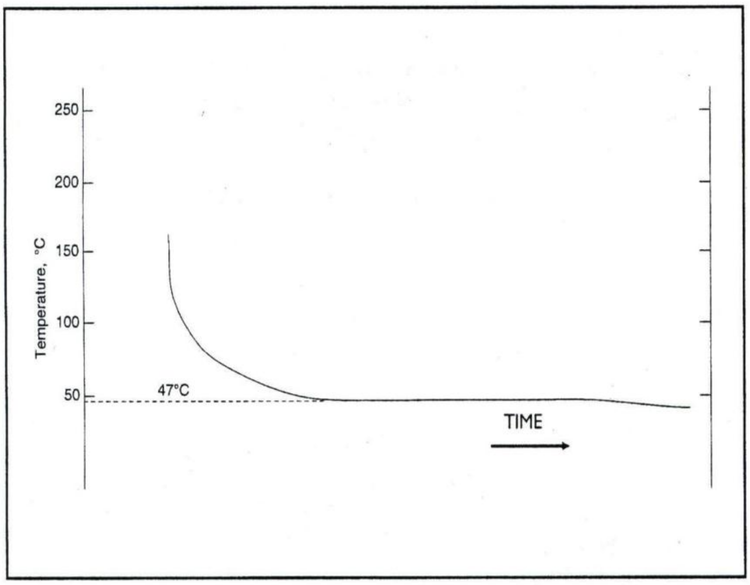

Fig. 1 SOLIDIFICATION

The trace obtained by solidification from a homeogeneous melt of a sample of 300g indicates a reasonably precise arrest at 47^{0}C. This may be compared with the behaviour in melting of newly solidified and mature samples (fig. 2).

Observation ceases before showing further reaction after solidification is complete: the reaction is observable in practice, but occurs between 40 and 30^{0}C over a period of about two hours for samples of the size used here.

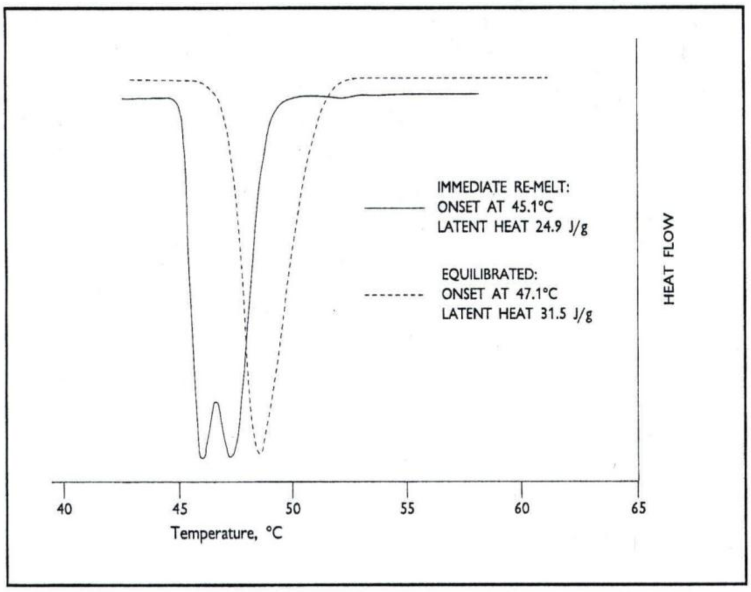

Fig. 2 MELTING

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

The melting pattern, like the latent of heat of fusion, is much altered in older specimens and illustrates the difficulty of defining a eutectic in an alloy of five metals.

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.

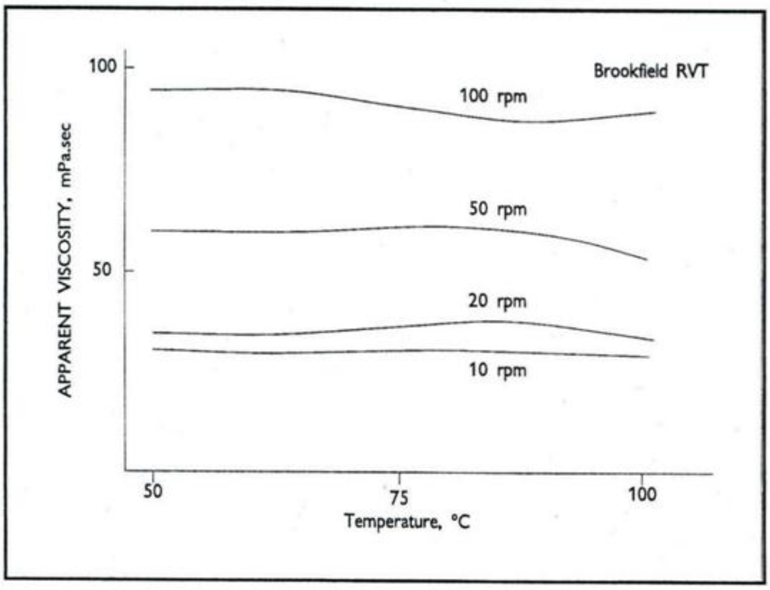

Fig. 3 GROWTH & SHRINKAGE

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, the rate of equilibration in the internal structure. Ultimately, differences are barely apparent between fully mature specimens, though a period of many months may be needed before this is achieved.

Curve A is for a 10mm square bar, 250mm in length, promptly quenched after solidification, which shows a zero nett growth after about 16 hours, thereafter remaining almost constant. The lower curve B is for a faster quenched, small specimen of 5 x 5 x 2mm.

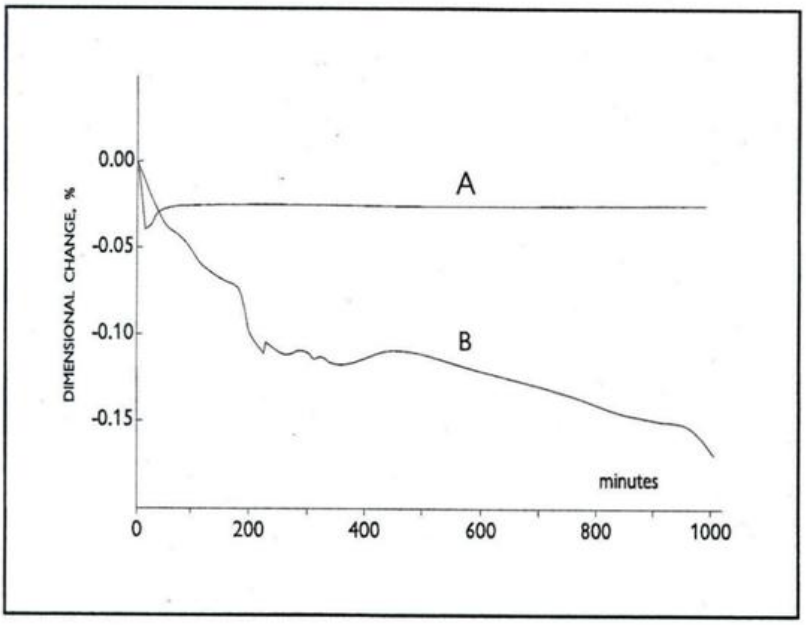

Fig. 4 VISCOSITY

Like that of most fusible alloys, the viscosity of MCP 47 is quite low. Slightly above the melting point (within, say 2^{0}C of the temperature at which melting is complete), it is of the order of 1 mPa.s. However, the surface tension is high within this range, causing practical measurements to suggest non-Newtonian behaviour.

The values indicated in the diagram were obtained by means of a Brookfield RVT viscometer, using 3 litres of liquid alloy in a cylindrical container with alloy depth being roughly equal to the 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 calculated.

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