5N PLUS

Product Data Sheet

MCP 69 Alloy

UPDATED ON 2012-07

TYPICAL USES

The alloy MCP 69 was introduced to overcome the problem of the voids which are occasionally found to form through segregation during very slow cooling of the related alloy MCP 70 during the preparation of shields for use in radiotherapy. This remains the principal use, although it finds occasional application as thermal fuse material.

PHYSICAL PROPERTIES

MCP 69 alloy was specially developed for use in radiation shields. Investigations by progressive separations of "last to freeze" fractions suggested this alloy of significantly different constituent proportions to the MCP70 that it was intended to replace in such work. MCP 69 has a very narrow melting range and no tendency to segregate as slow solidification takes place.

Despite the large differences in composition, there is very little difference in the post solidification dimensional changes between MCP 69 and MCP 70 (see fig. 3, overleaf).

Melting behavior is rather complex and depends *inter alia* on the age and thermal history of the alloy. In common with all alloys of low melting point, MCP 69 undergoes equilibration after solidification. The equilibration gives rise to slow dimensional changes, which occur at rates dependent on the immediate post solidification treatment.

Despite the complexities in a quaternary alloy, MCP 69 shows remarkable compositional stability through repeated cycles of melting and freezing (see page 2).

Characteristic	Typical Value
Density	9.79 g/cm^3
Brinell Hardness	8.8 -10.8
Melting Point	70°C
Specific heat at 25°C (solid)	0.147 J/g.°C
Specific heat at 150°C (liquid)	0.185 J/g.°C
Enthalpy of fusion	31.0 J/g
Electrical resistivity	60 mΩ.cm

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

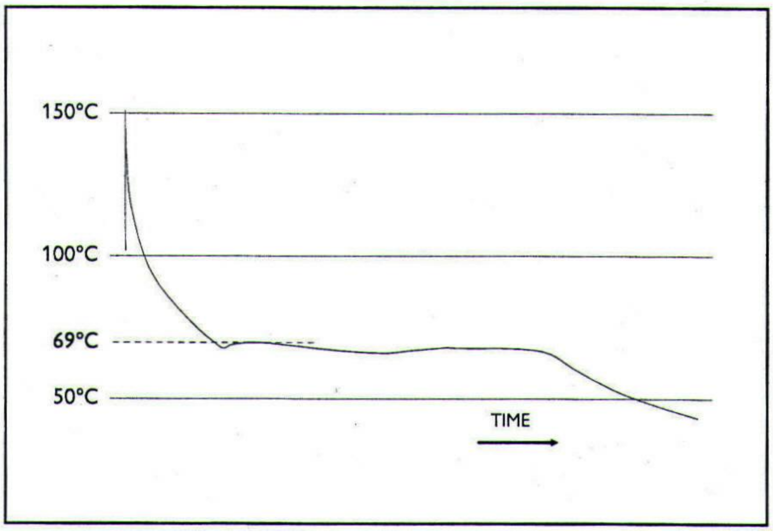

Fig. 1 SOLIDIFICATION

The trace obtained by solidification from a homogeneous melt of a sample of 300g shows initial supercooling before a first arrest at about 69^{0}C. This is followed by a reasonably precise plateau, not sufficient level; however, to suggest that the composition is accurately eutectic and in fact indicating further reaction while solidification is being completed. This may be compared with the behavior in melting of newly solidified and mature samples (fig. 2).

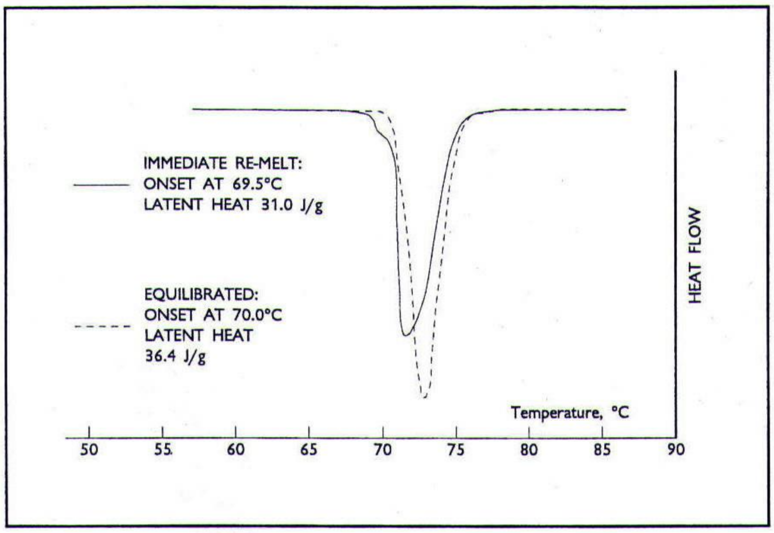

Fig. 2 MELTING

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

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.

Unlike the onset temperature, the latent heat of fusion is found to have increased significantly with specimen age: the discrepancy corresponds to the latent heat of the slow changes taking place after solidification.

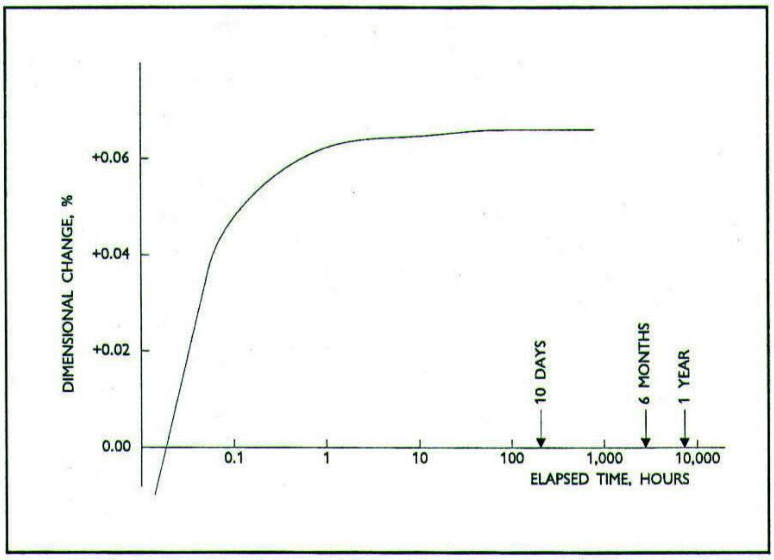

Fig. 3 GROWTH & SHRINKAGE

The curve shown is for a 10mm square bar, 250mm in length and, promptly quenched after solidification, displaying a net growth of 0.06% after about one hour which then continues very slowly to a final, stable value close to 0.07%. The curve in practice depends on the size, shape and treatment of the alloy, which affect the rate of cooling after solidification and, thus, equilibration of the internal structure: differences are barely apparent after 6 months, with growth ceasing at +0.07%.

The onset temperature for melting (fig. 2) is found to be little altered in very old specimens, suggesting that the alloy is suitable for thermal protection devices; however, it is necessary to test the effect of growth of the alloy in such an application.

STORAGE AND USE

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