Super KFC Series and KLF170 Copper Alloys for Leadframes

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Leadframes contribute to the high reliability and high performance of semiconductor packages. Raw materials of leadframes require good stamping formability, etching formability and platability, along with strength and electrical conductivity. Conventional QFPs (Quad Flat Packages) are being replaced by QFNs (Quad Flat Non-leaded packages), which are easier to downsize. The QFNs require excellent dice formability (dicing) because of their manufacturing process. Kobe Steel developed copper alloys, namely "super KFC series" and "KLF170", in response to the advent of the QFNs.

The Super KFC (SPKFC) alloys are a series developed for thinner and larger leadframes, based on KFC (C19210) alloy of which more than 4,000 tonne/month is produced worldwide.

The KLF170 alloy is the first Cu-Ni-P alloy in the world, which is mass-produced for electronic applications.This alloy is featured by high strength and high electrical conductivity to ensure quality and reliability of packages. The alloy has no large precipitates in its raw material and no smut occurring during the pre-plating processes, which used to be problems in the conventional high-strength alloys.

Features

1) The SPKFC-1 enables direct bonding
   The alloy does not require any frame plating at the user's sites, reducing the package costs.
2) Smooth, smut-free etched surface with lower internal residual stress
   These are indispensable characteristics for QFN frames, which frequently employ half-etching.
   The curvatures of frames are reduced and, thus, enable size growth of leadframes and packages.
3) Excellent dice formability (Dicing)
   The characteristics is required for QFN to ensure the reliability of downsized packages.
4) No protrusion after Ag plating
   This feature ensures the reliability of the packages.

Properties

1) Basic properties
   Table 1 summarizes the basic properties. The softening resistance and bending formability of the developed alloys are equivalent to, or better than, the conventional alloys.
2) Etching characteristics (**Photo 1**)
   The developed alloys have smooth surfaces after etching, because these include no large precipitation.
3) Silver platability (**Photo 2**)
   The developed alloys have excellent surfaces after silver plating, because they include no large precipitates that may cause abnormal protrusions.
4) Dice formability (**Figure 1**)
   The developed alloys have excellent dice formability with reduced burrs, which deteriorate quality and productivity of QFNs.

Table 1 Basic properties of the developed alloys and comparative alloys

Alloy \ Property	Tensile strength (MPa)	Elongation (%)	Hardness (MHV : 0.5)	Conductivity (%IACS)
SPKFC-1	570	7	165	78
SPKFC-2	580	11	175	70
C19400	560	7	160	63
C18040	580	7	170	75
SPKFC-3	670	7	200	50
KLF170	670	7	200	65
C70250	680	11	200	53

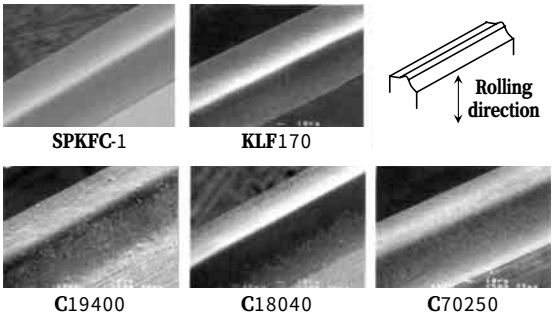

Photo 1 Etching formability of the developed alloys and comparative alloys

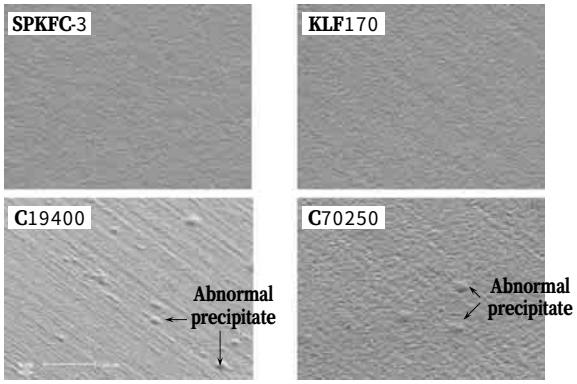

Photo 2 Silver platability of developed alloys and comparative alloys

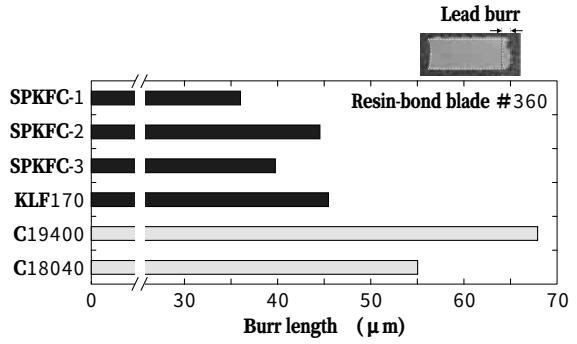

Fig. 1 Dice formability of developed alloys and comparative alloys