
LEAD-FREE ACTIVITIES



Product Engineering & Quality / July 2003

LEAD-FREE ACTIVITIES

LEGAL RESTRICTIONS

EUROPE

From 1st July 2006, Pb will not be permitted in the majority of electronic products produced or sold in Europe:

1. Member States shall ensure that, from 1 July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). National measures restricting or prohibiting the use of these substances in electrical and electronic equipment which were adopted in line with Community legislation before the adoption of this Directive may be maintained until 1 July 2006.

(Article 4, Paragraph 1)

The following are exempted from this provision:

- Lead in glass of cathode ray tubes, electronic components and fluorescent tubes
- Lead in high melting temperature type solders (i.e. tin-lead alloys containing more than 85% lead)
- Lead in solders for servers, storage and storage array systems (exemption granted until 2010)
- Lead in solders for network infrastructure equipment for switching, signalling, transmission as well as network management for telecommunication.
- Lead in electronic ceramic parts (e.g. **piezoelectronic devices**)

Directive 2002/95/EC of the European Parliament of 27 January 2003

U.S.A.

No legal base.

JAPAN

No legal base.

LEAD-FREE ACTIVITIES ADDITIONAL MOTIVATIONS

Japanese Home Electronics Recycling Law

"We need suitable treatment not to release Pb into the environment."

Danish Decree

concerning the prohibition of the import and sale of products containing lead.

Review of criteria of EC legislation in 2004

"By 1. January 2004 the Commission shall review the requirements of Article 4 to take into account, as necessary, new scientific evidence."

Public Awareness



Competition

Corporate Customer OEM-Customer Consumer

LEAD-FREE ACTIVITIES MARKETING CONSIDERATIONS

- 20%** of consumers actively consider the environment when making a purchase.
- 45%** of consumers have bought a product because it is environmentally safe.
- 50%** of consumers have switched brands upon finding that a product hurts the environment.
- 76%** of consumers will switch to an environmentally safe product if price and quality are comparable.

Marketing Research, 1999
Motorola Advanced Technology Center

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MARKET ACTIVITIES

Japanese Electronics Industry Development Association (JEIDA)

Year 2000	Adoption of lead-free components.
Year 2000	Adoption of lead-free solders in wave soldering.
Year 2001	Expansion of use of lead-free components.
Year 2001	Expansion of use of lead-free solders in new products.
Year 2002	General use of lead-free solders in new products.
Year 2003	Full use of lead-free solders in all new products.
Year 2005	Lead-containing solder used only exceptionally.

Sony Green Management Plan 2002

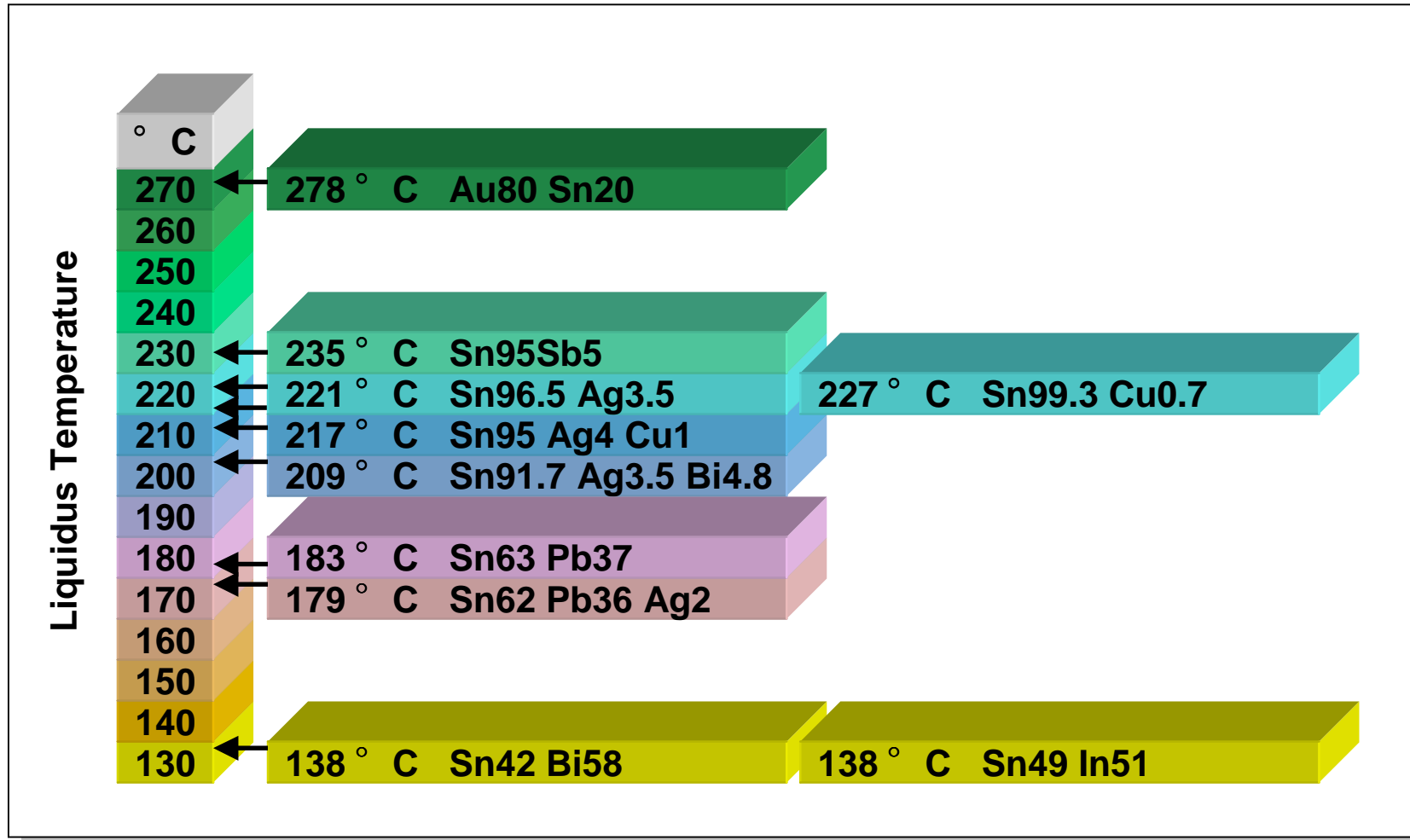
March 2000	Use in at least one model.
March 2002	Use in all models.

Ford Motor Company (EU)

End of 2002	All electronic assemblies are lead-free.
End of 2004	All vehicles, aside from batteries, are lead-free.

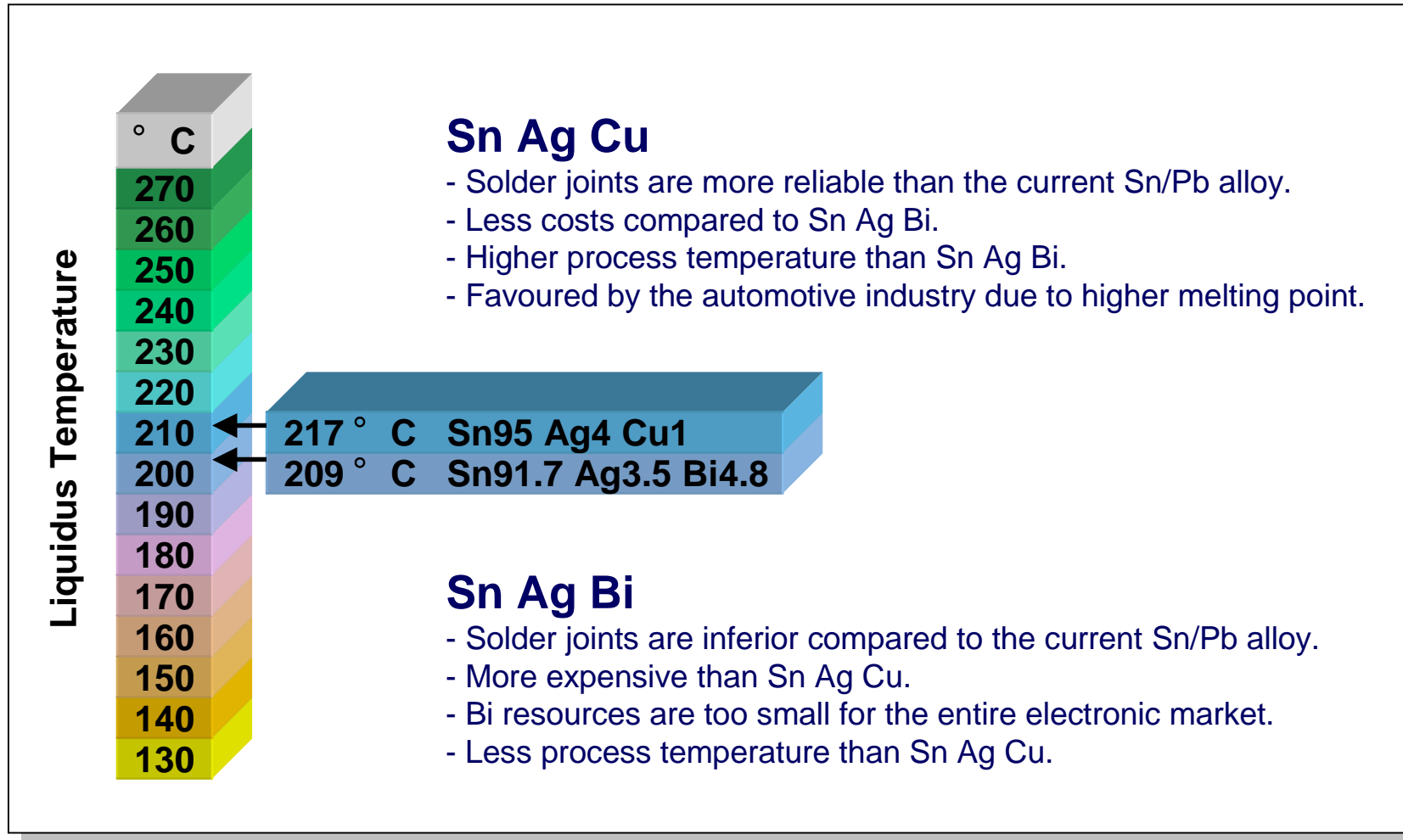
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SOLDER ALLOY COMPOSITIONS



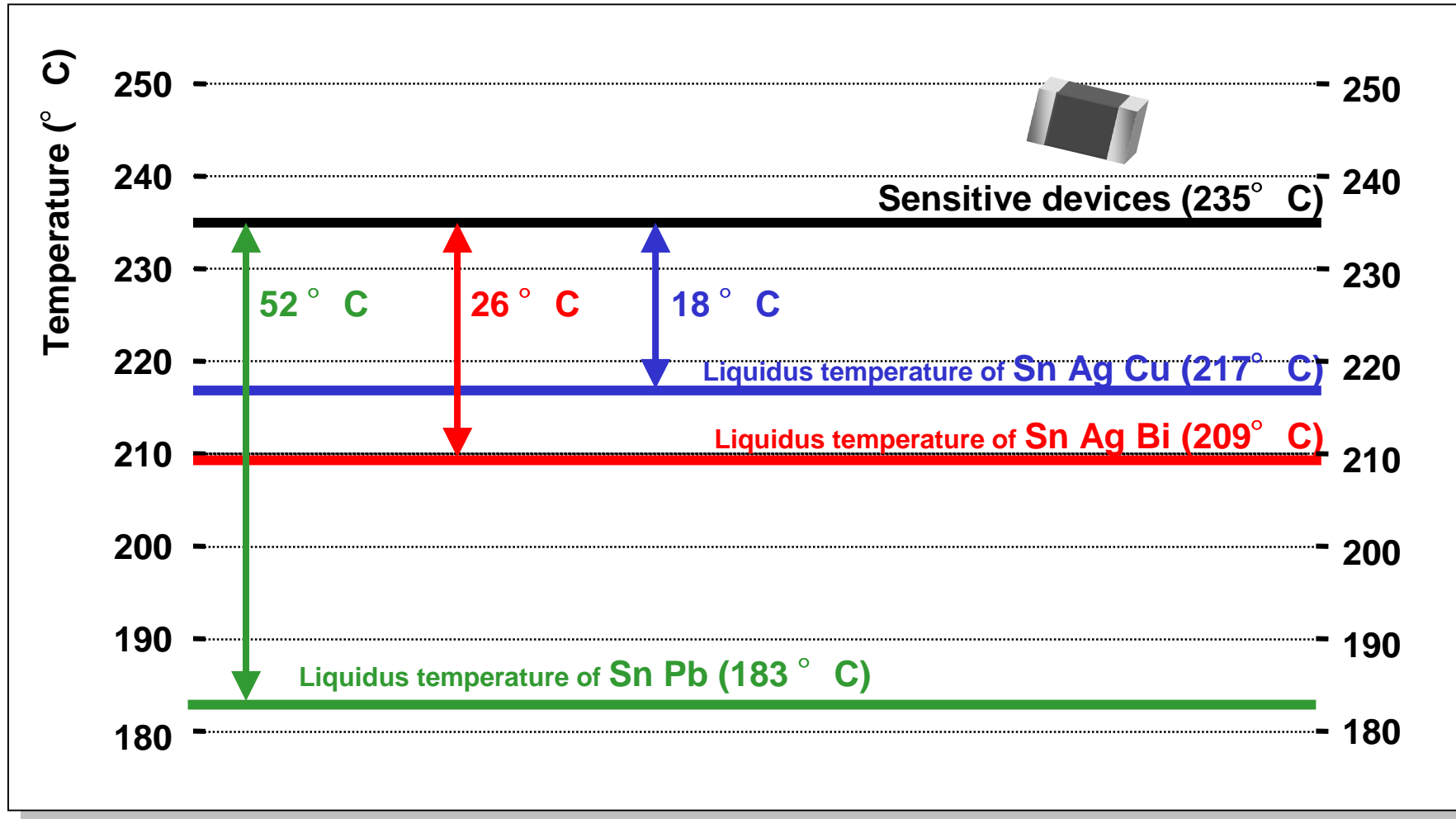
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THE FAVOURED SOLDER ALLOY COMPOSITIONS



LEAD-FREE ACTIVITIES

TECHNICAL CONSIDERATIONS



LEAD-FREE ACTIVITIES

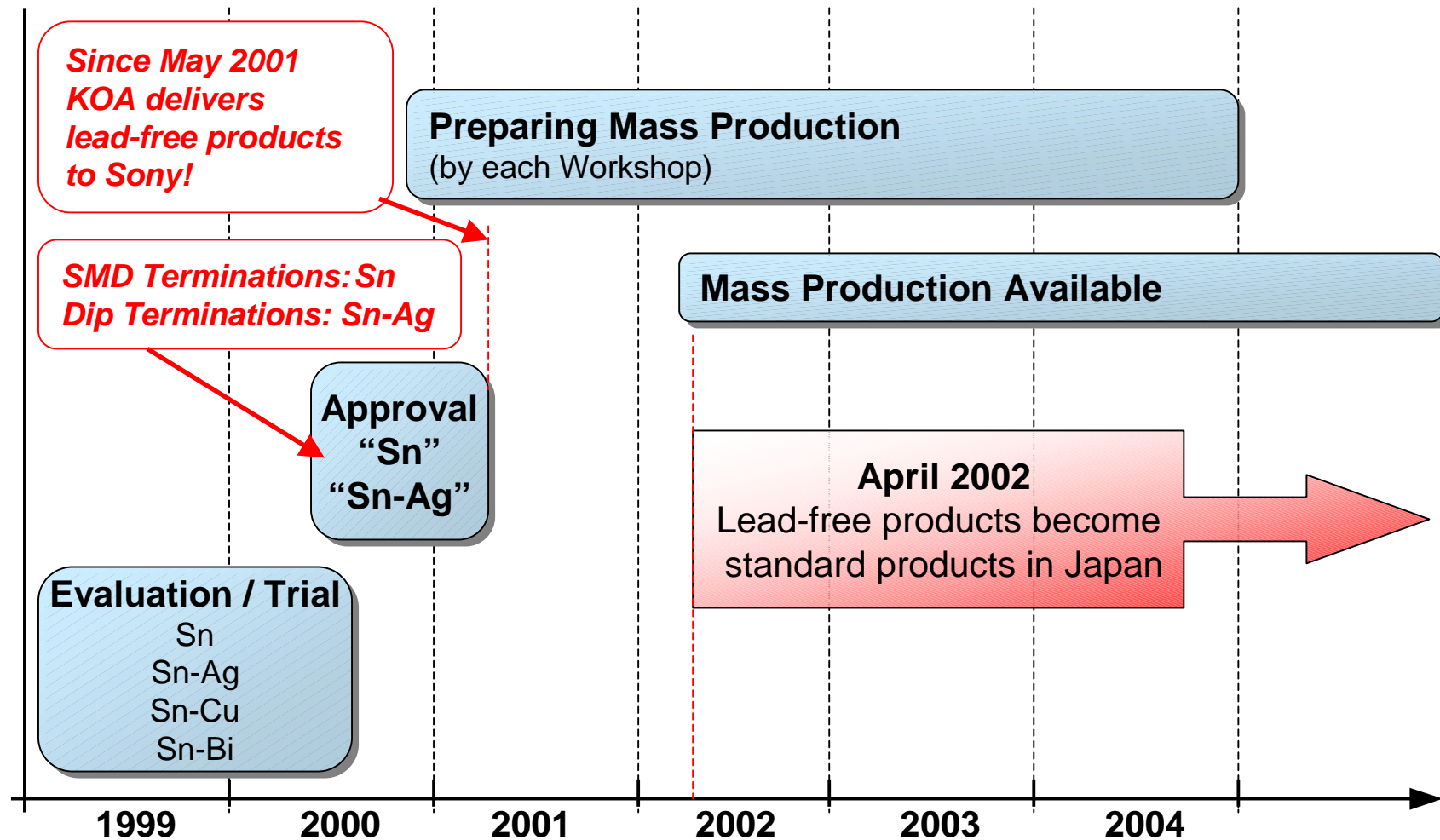
TASKS FOR THE PRODUCT MANUFACTURERS

Component Manufacturer are faced with a three-part challenge.

- 1. Remove lead from the products.**
- 2. Develop terminations that are compatible with lead-free solders. (e.g. Sn-Ag, Sn-Cu, Sn-Bi, Sn, etc.)**
- 3. Develop components with higher temperature tolerances.**

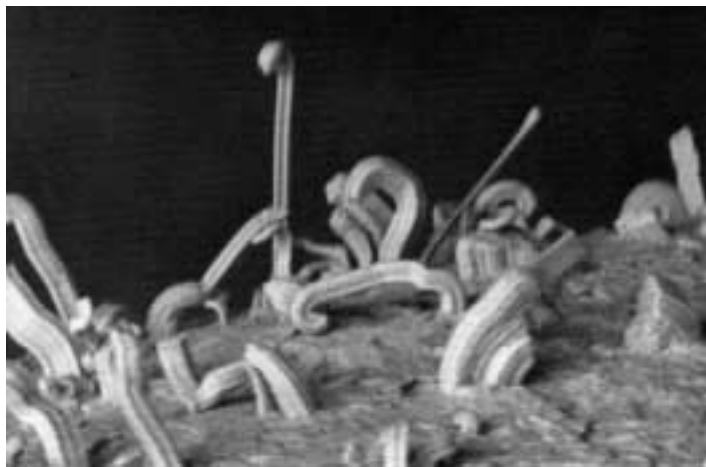
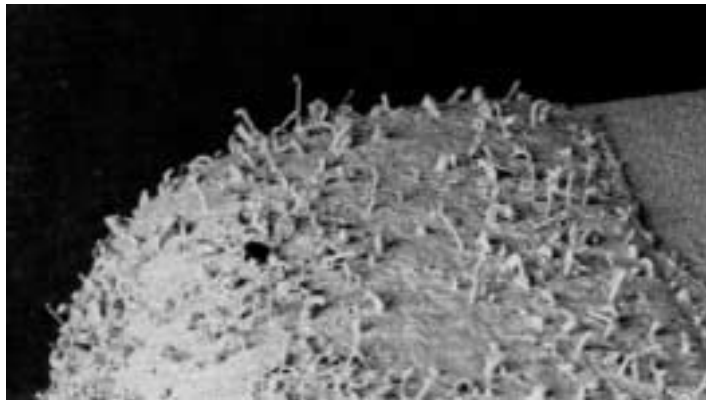
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KOA'S ACTIVITIES – SMD PRODUCTS



LEAD-FREE ACTIVITIES

WHISKER GROWTH IN SN – BACKGROUND

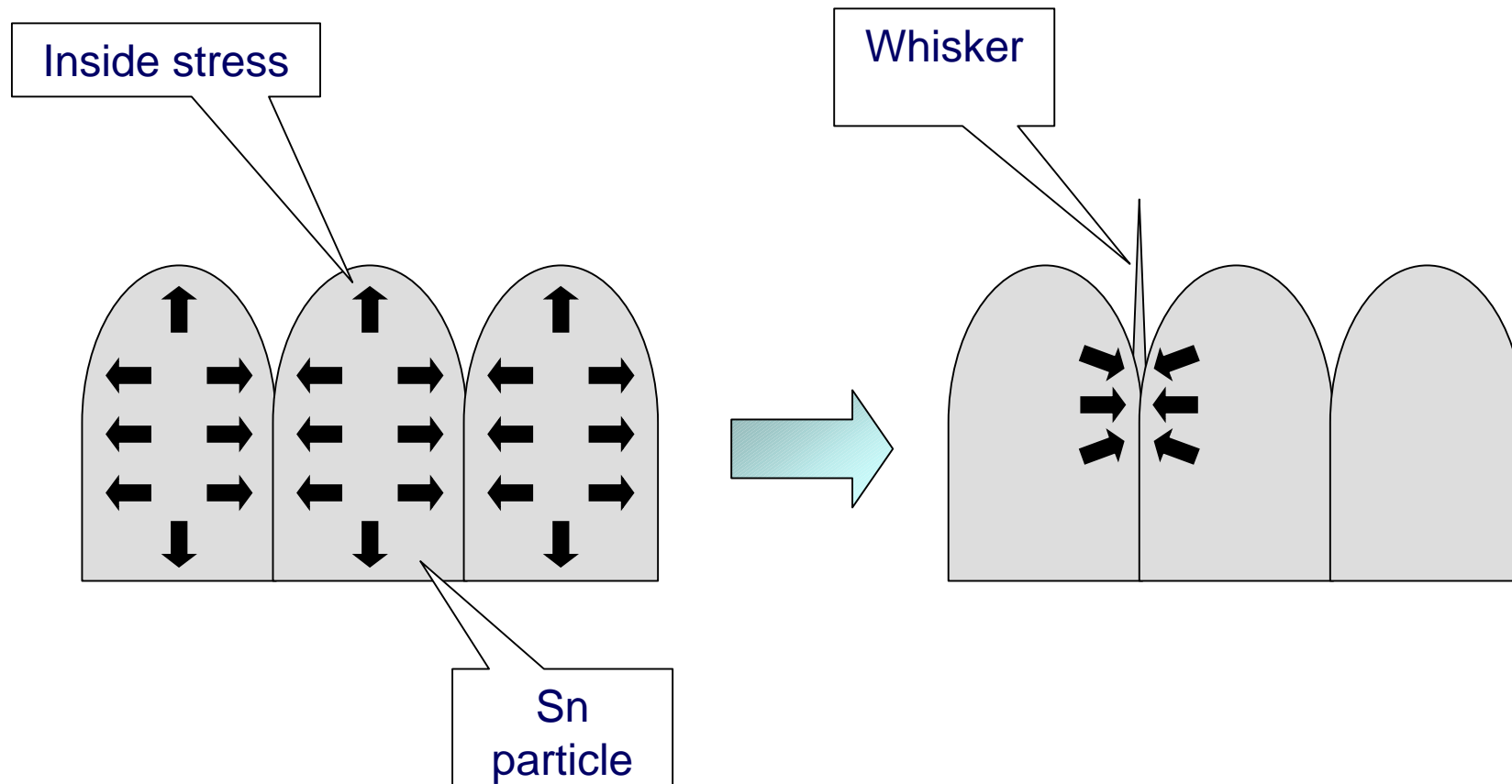


Tin whiskers are electrically conductive, single crystal structures that can grow from surfaces that use tin (especially electroplated tin) as a final finish. Tin whisker growth is believed to be purely mechanical phenomenon.

Source: NASA Goddard Space Flight Center

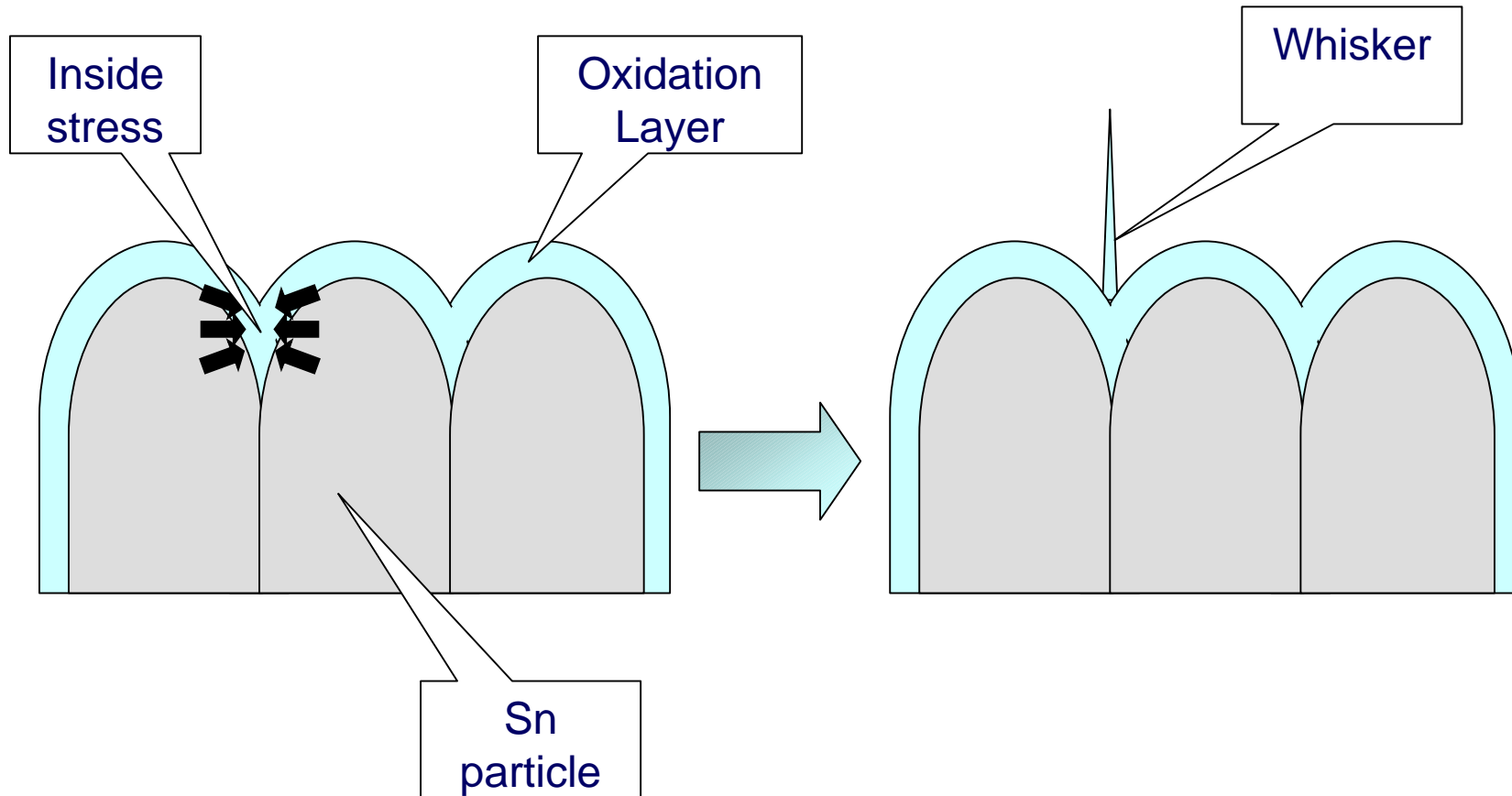
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WHISKER GROWTH IN SN – INSIDE STRESS OF SN PARTICLES



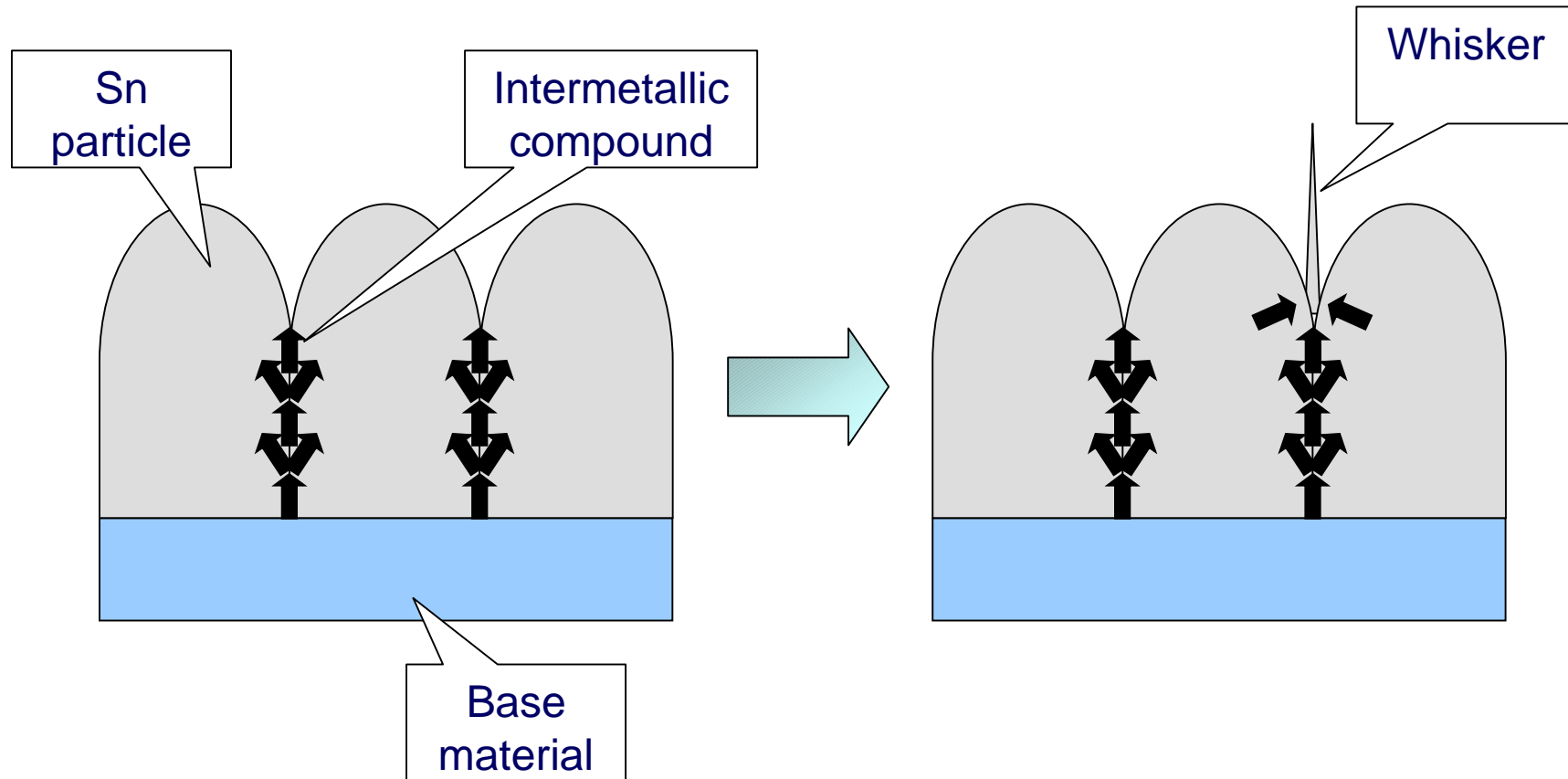
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WHISKER GROWTH IN SN – STRESS BY SN OXIDATION LAYER



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WHISKER GROWTH IN SN – STRESS BY INTERMETALLIC COMPOUND



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WHISKER GROWTH – PREVENTIVE ACTION

1. Inside stress of Sn particles

Plating materials and conditions are determined to minimize stress.

2. Stress by Sn oxidation layer

The storage conditions should be $<40^{\circ}$ C and $<70\%$ r.h. to avoid oxidation layer.

3. Stress by intermetallic compound

A Ni barrier is used to avoid diffusion of substances from the base material to the Sn.

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WHISKER GROWTH – RELIABILITY TESTS

1. Temperature Cycling

-55° C / 125° C – 1000 cycles

2. Moisture Test

85° C / 85%r.h. – 1000 hours

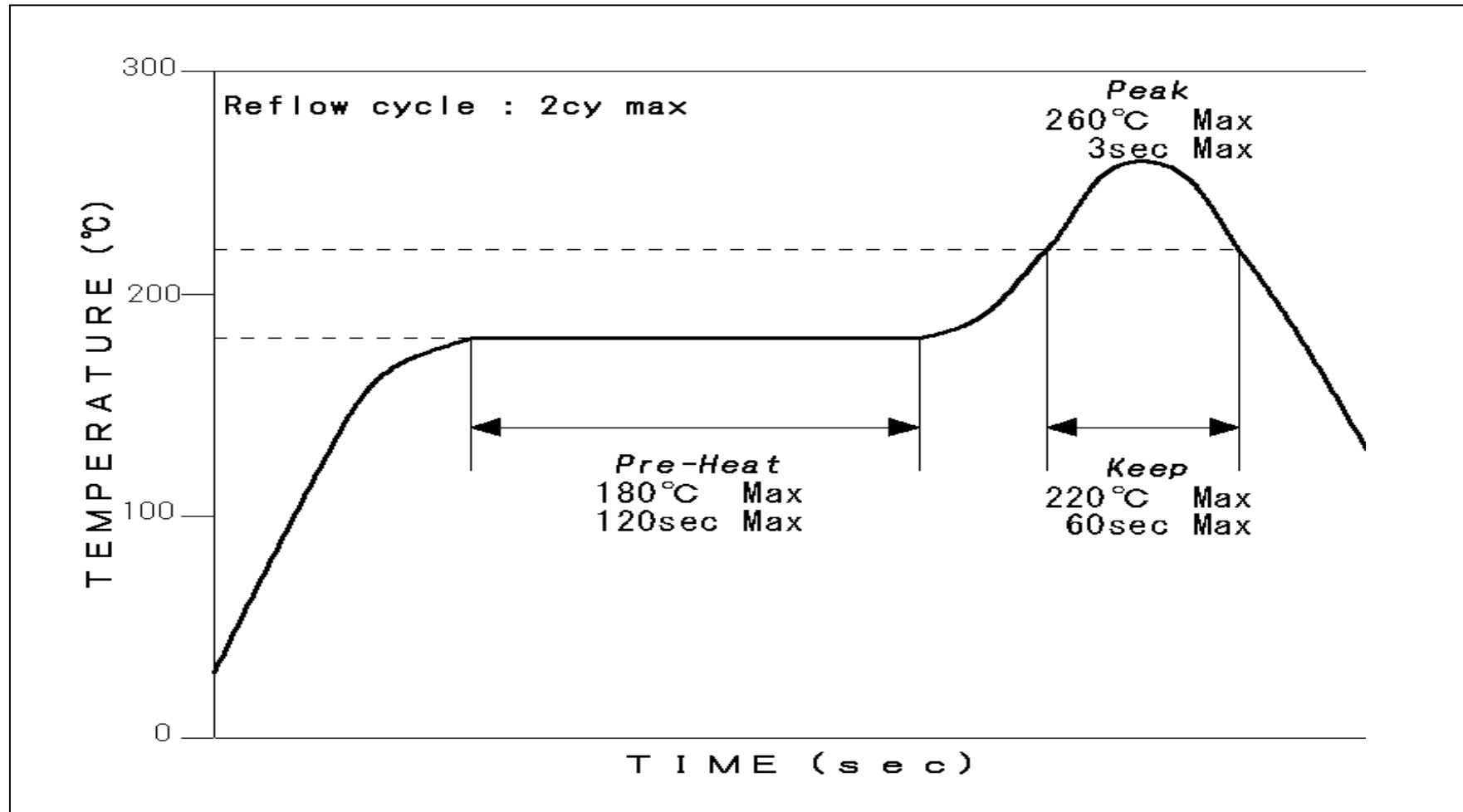
Requirements:

Length of whisker < 50 µm

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SOLDER PROFILE FOR KOA RESISTORS (THIN & THICK F/C)

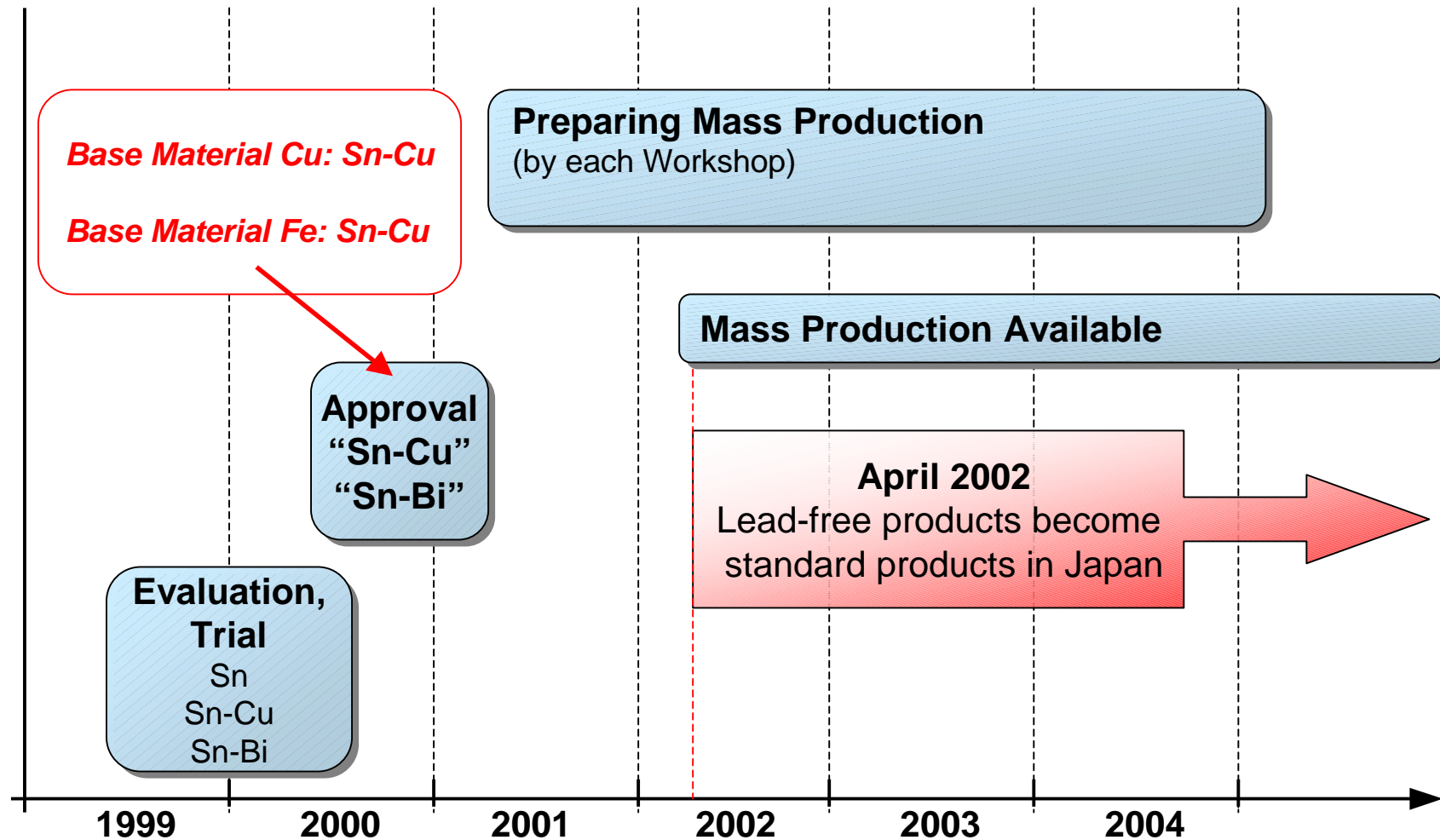
(RN73 & RK73 series)



Wave soldering: 260° C / 10s (1cycle)

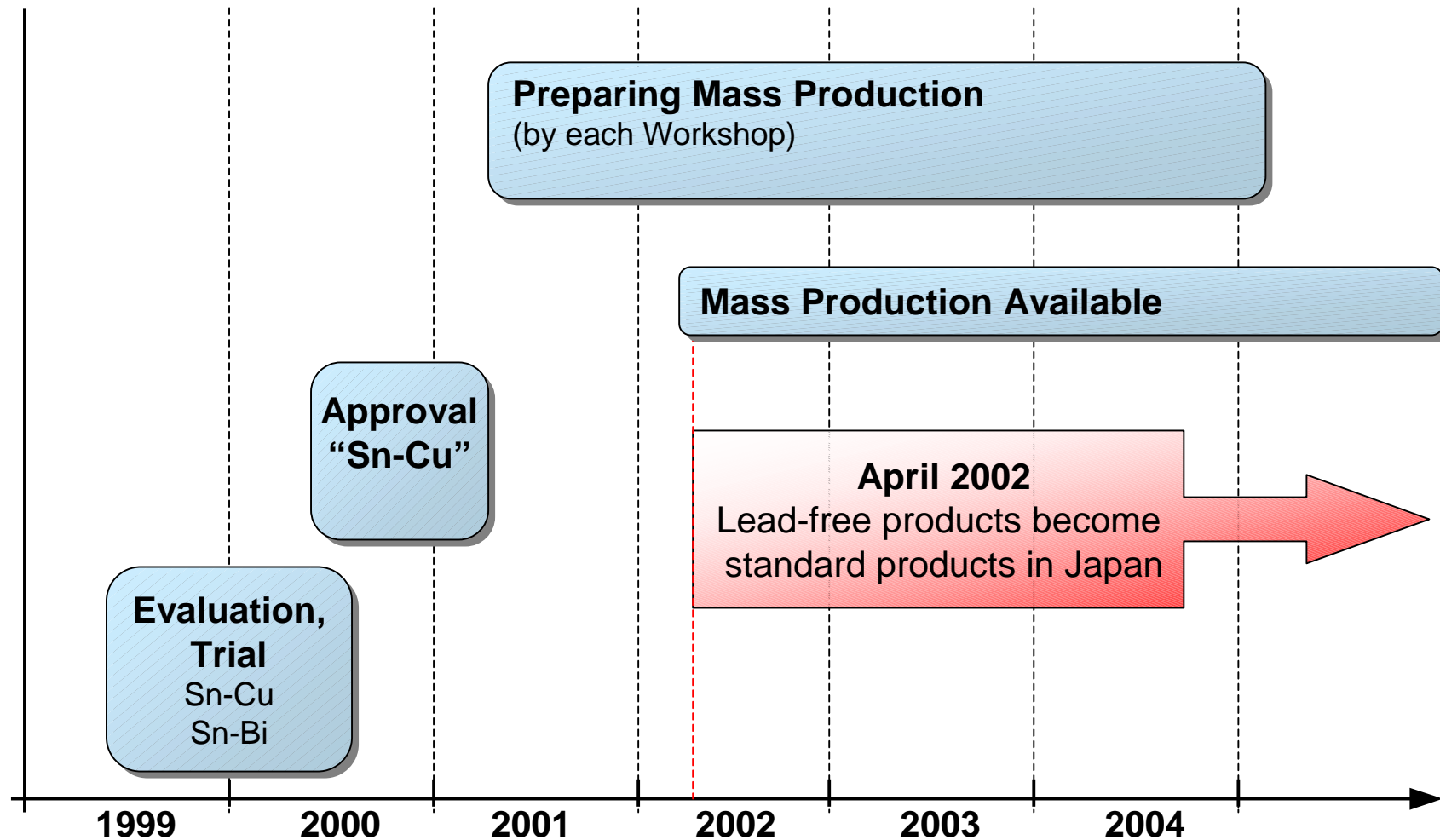
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KOA'S ACTIVITIES – LEADED PRODUCTS



LEAD-FREE ACTIVITIES

KOA'S ACTIVITIES – LEAD FRAME TERMINATIONS



LEAD-FREE ACTIVITIES

LEAD FREE & GLOBAL PARTNUMBR

1. Surface Plating Lead Free of Terminals

- SMD: Sn
- Leaded: Sn-Cu

2. Lead Free Samples

Available now

3. Mass Production Start

From orders received July, 2002 onwards

4. Characteristics

No differences between current products and lead free one

5. Global partnumber

New partnumber identifies Lead free products

E.g.: RK73H1J**TTD**100**2F**

Termination Value **tolerance**

Lead free

LEAD-FREE ACTIVITIES

KOA'S IDEALS

To take good care of humanity.

To pay attention to natural environment.

To make our life well-off.

