The effect of Germanium additions on SN100C

Nihon Superior Co., Ltd.

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What is SN100C?

SN100C is a lead-free solder that is based on the Tin-Copper Eutectic: Sn-0.7Cu

with a trace addition of Ni at a very specific level

and

Germanium (Ge).

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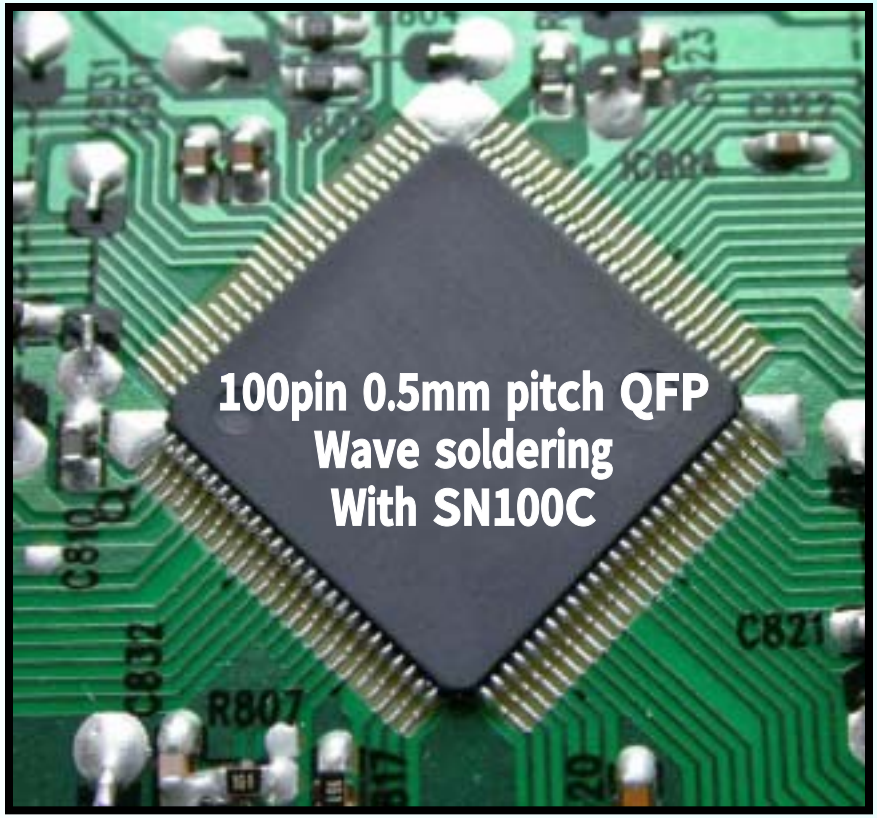
The effect of Germanium additions

I - The effect of bridge elimination

The effect of bridge elimination on SN100C

SN100C makes bridge-free soldering possible even with 100pin 0.5mm pitch QFP.



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The mechanism of bridging

Whether or not bridging occurs depends on what happens as the joint exits the wave (the “peel back” area)

To study the effect of bridge elimination, the icicle test was carried out and the drainage characteristic of solder wave were confirmed.

[Results]

1. The Ni addition to the Sn-Cu lead-free increases fluidity of the solder and eliminates bridging.

2. The addition of Ge to the Sn-Cu-Ni alloy to make “SN100C” improves the drainage properties of the solder to further reduce any tendency to bridging.

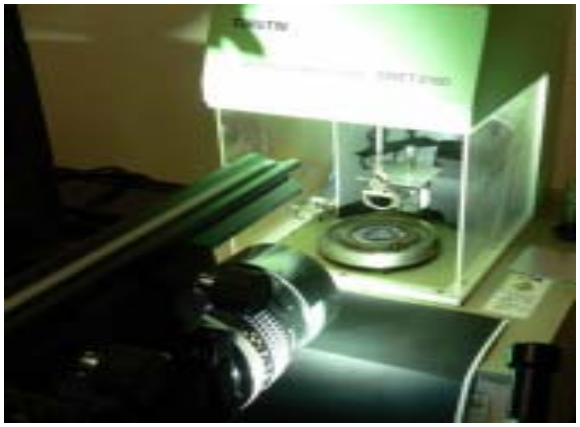
Icicle test

[Test conditions]

- Test piece: Oxygen free copper ring (20mm ID, wire diameter 2.0mm)
- Solder alloys: **SC, SCN, SN100C, SCNP, SC0.3A, SCAB, S3A0.5C, S37P**
- Flux: JIS Standard flux A and B
- Melting temperature: 255 ℃
  (235℃ only for S37P)
- Immersion depth: 6mm
- Immersion speed: 4mm/s
- Immersion time: 20s
- Withdrawal speed: 2mm/s

Test piece: Oxygen free copper ring

Wetting balance test equipment
(Tarutin Kester)



*High Speed Camera
MEMRECAMfx K4
(nac Image Technology., Inc)

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Icicle test

Solder alloy samples

(%)

		Sn	Pb	Cu	Ni	P	Ag	Bi	Ge
SC system	SC	R		0.7					
SCN system	SCN	R		0.7	0.05				
	SN100C	R		0.7	0.05				0.01
	SCNP	R		0.5	0.05	0.05			
SCA system	SC0.3A	R		0.7			0.3		
	SCAB	R		0.7			0.3	0.1	
SAC system	S3A0.5C	R		0.5			3.0		
SP system	S37P	R	37						

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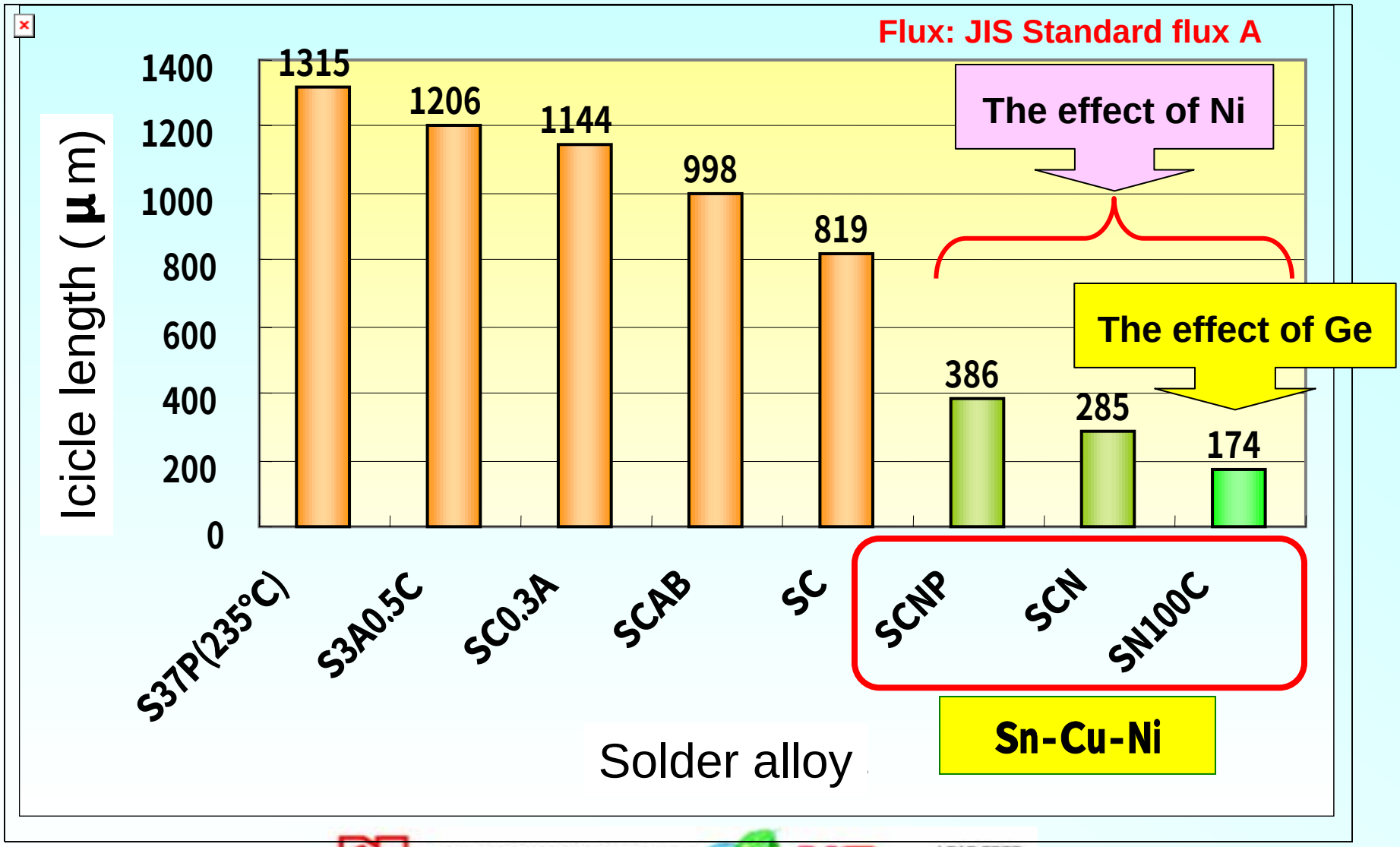
Test results



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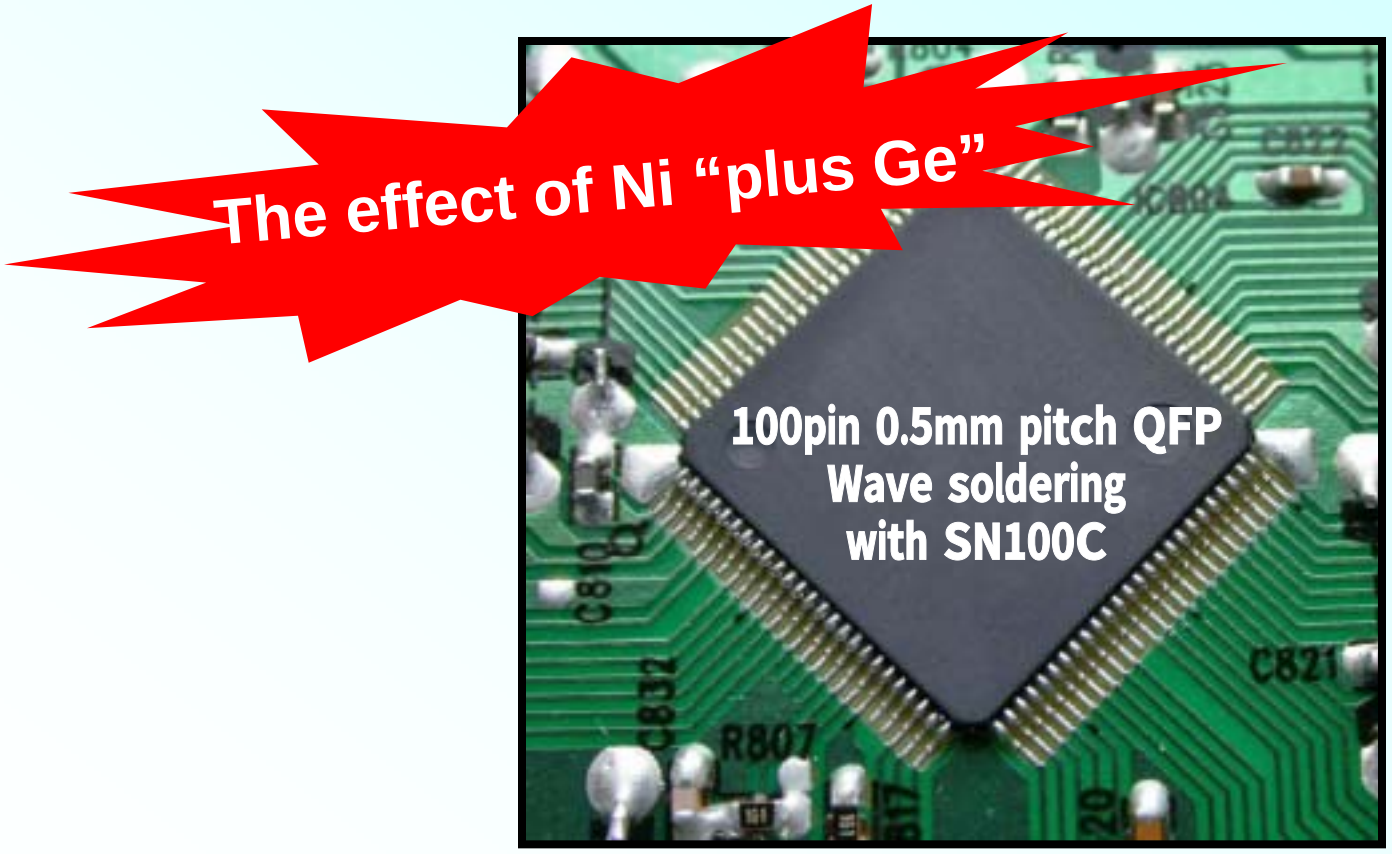

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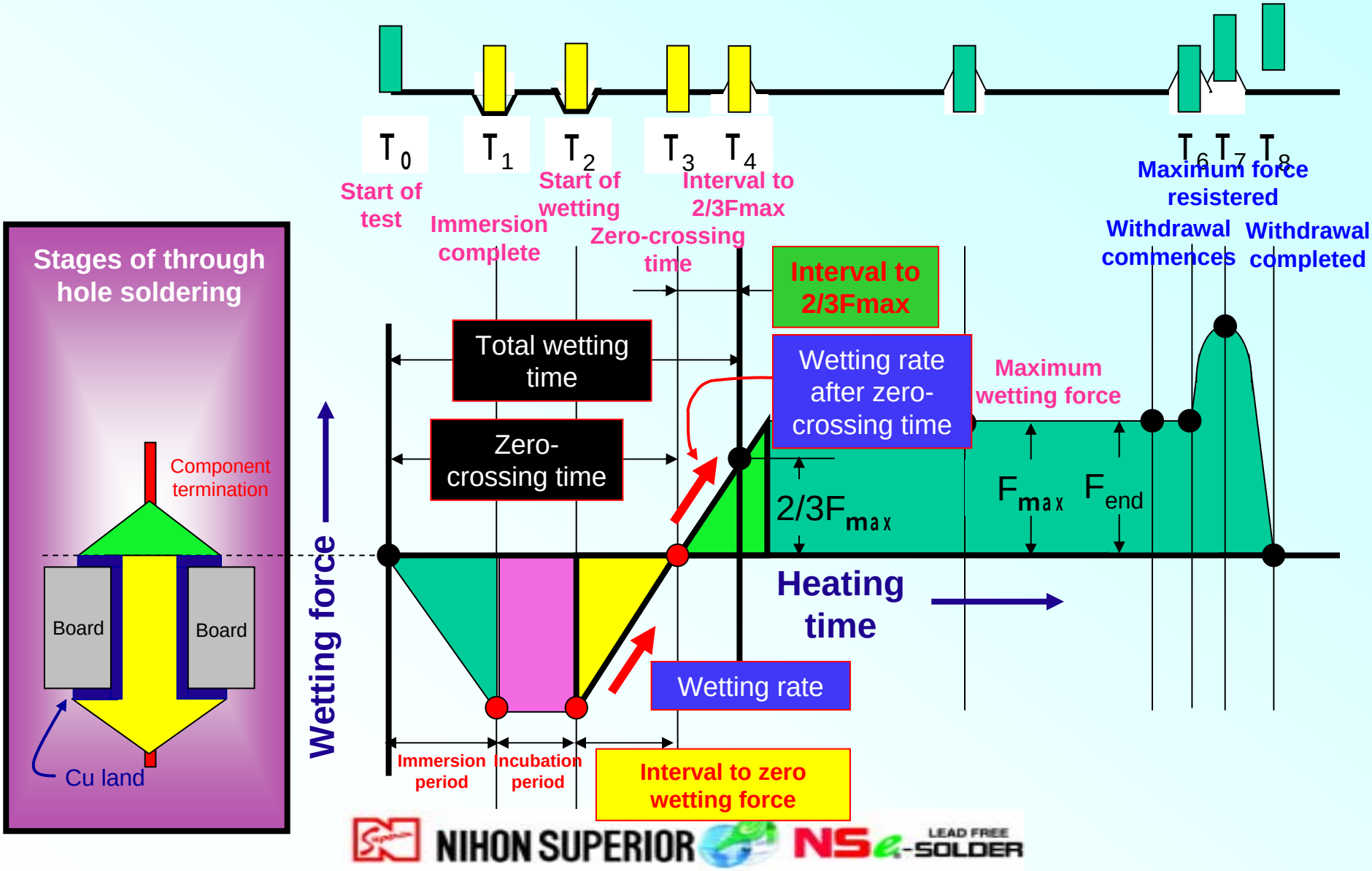
The effect of Germanium additions

II - Wetting properties

Wetting test – Meniscographic method



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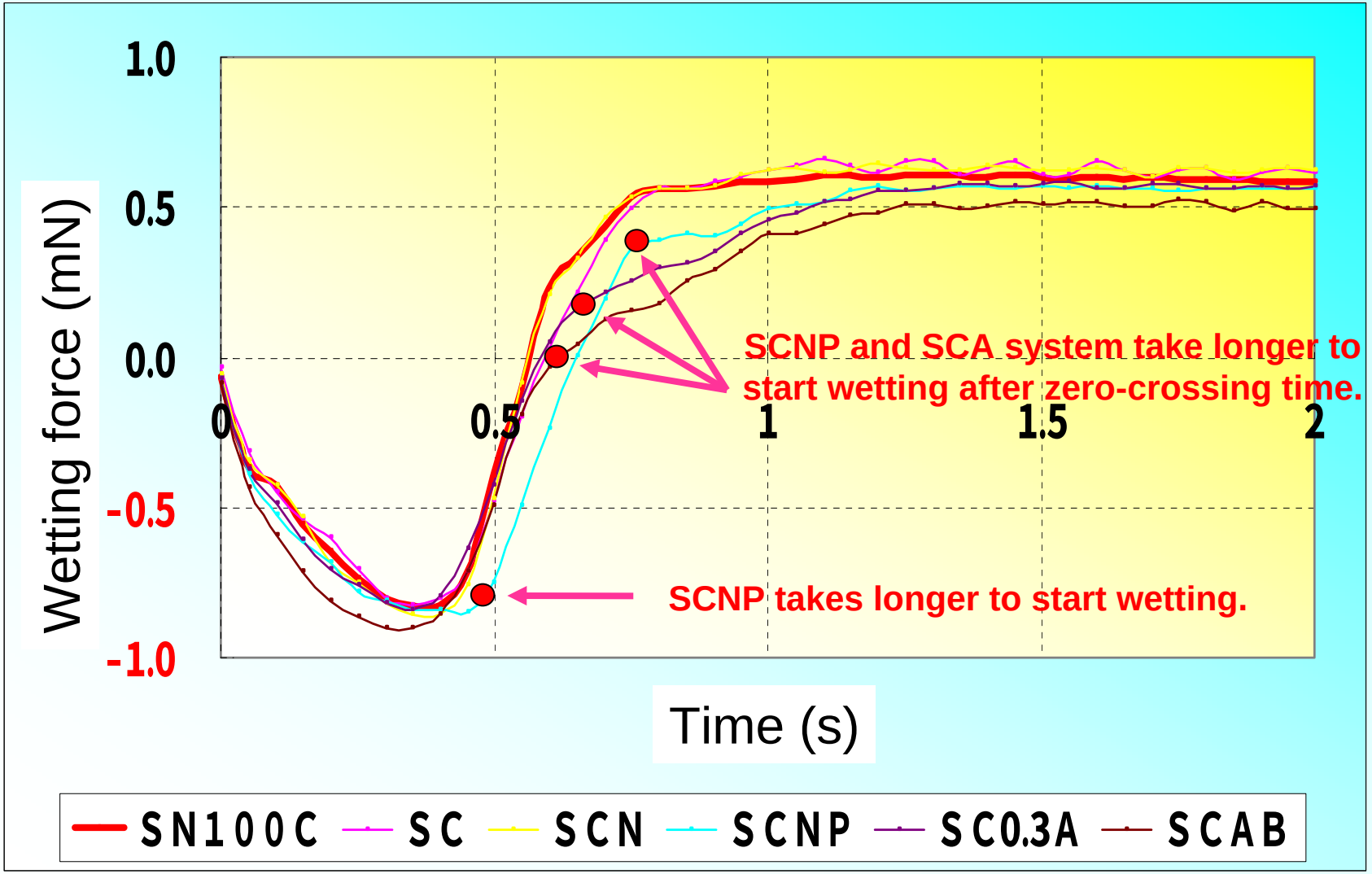
Test conditions

[Test conditions]

- Test piece: Copper wire
  (wire diameter 0.6mm, length 30mm)
- Solder alloys: SN100C, SC, SCN, SCNP, SC0.3A, SCAB
- Flux: JIS Standard flux B (for meniscographic test)
- Melting temperature: 255℃
- Immersion time: 10 sec.
- Immersion depth: 2 mm
- Immersion speed: 2mm/s
- Withdrawal speed: 2 mm/s

Test piece: Copper wire

Wetting properties of Sn-Cu system lead-free solder



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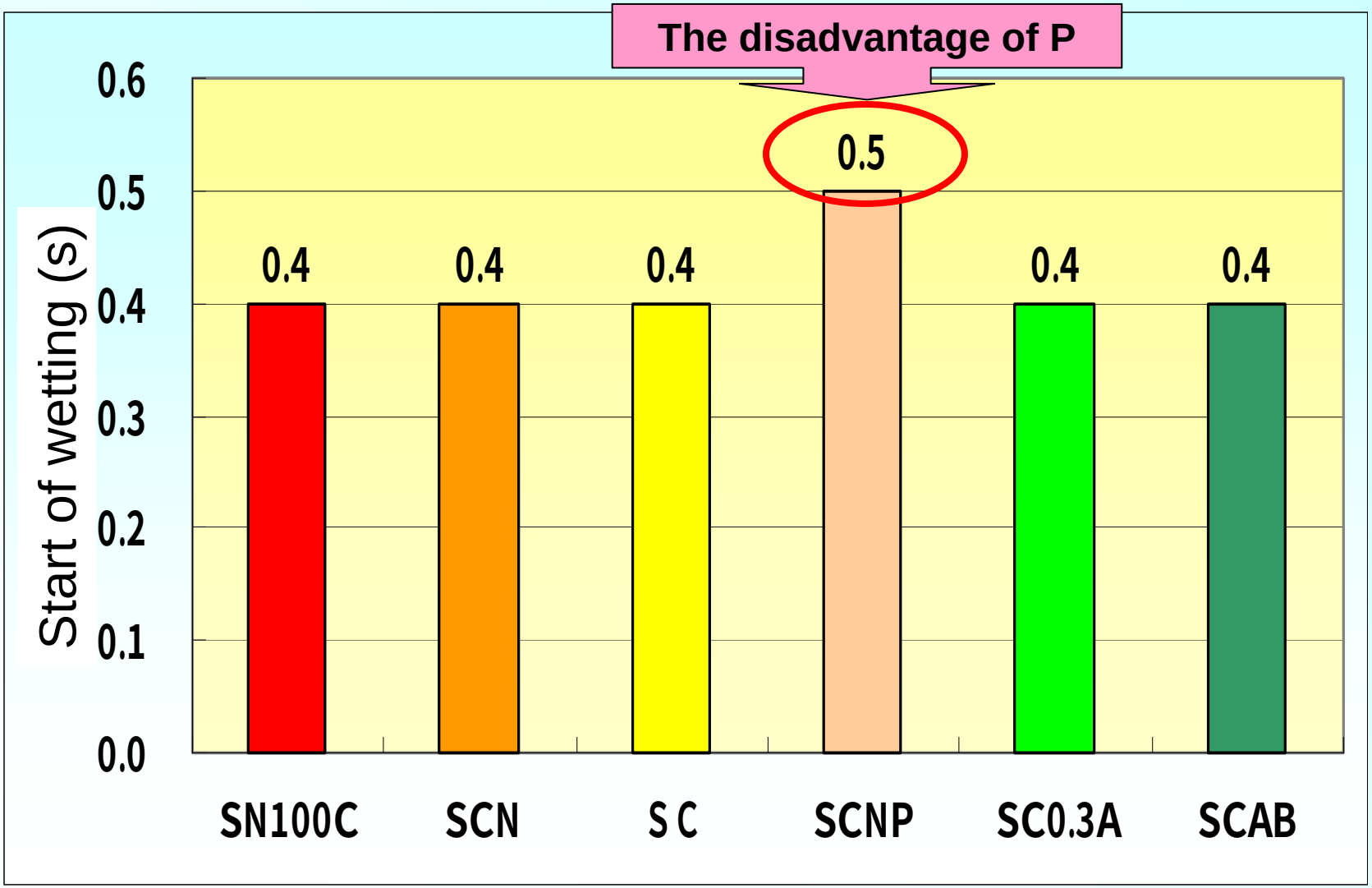
Start of wetting



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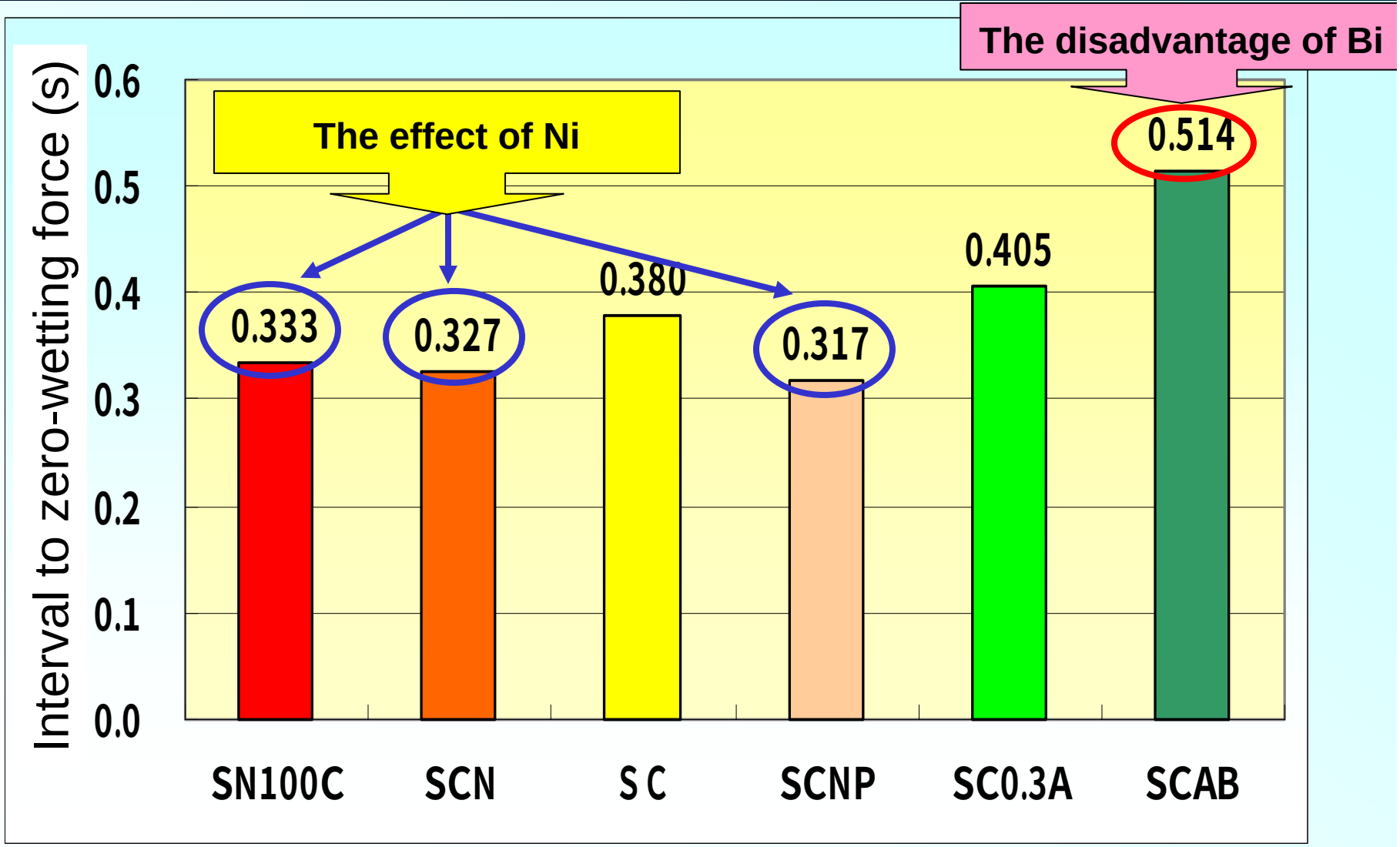
Interval to zero-wetting force



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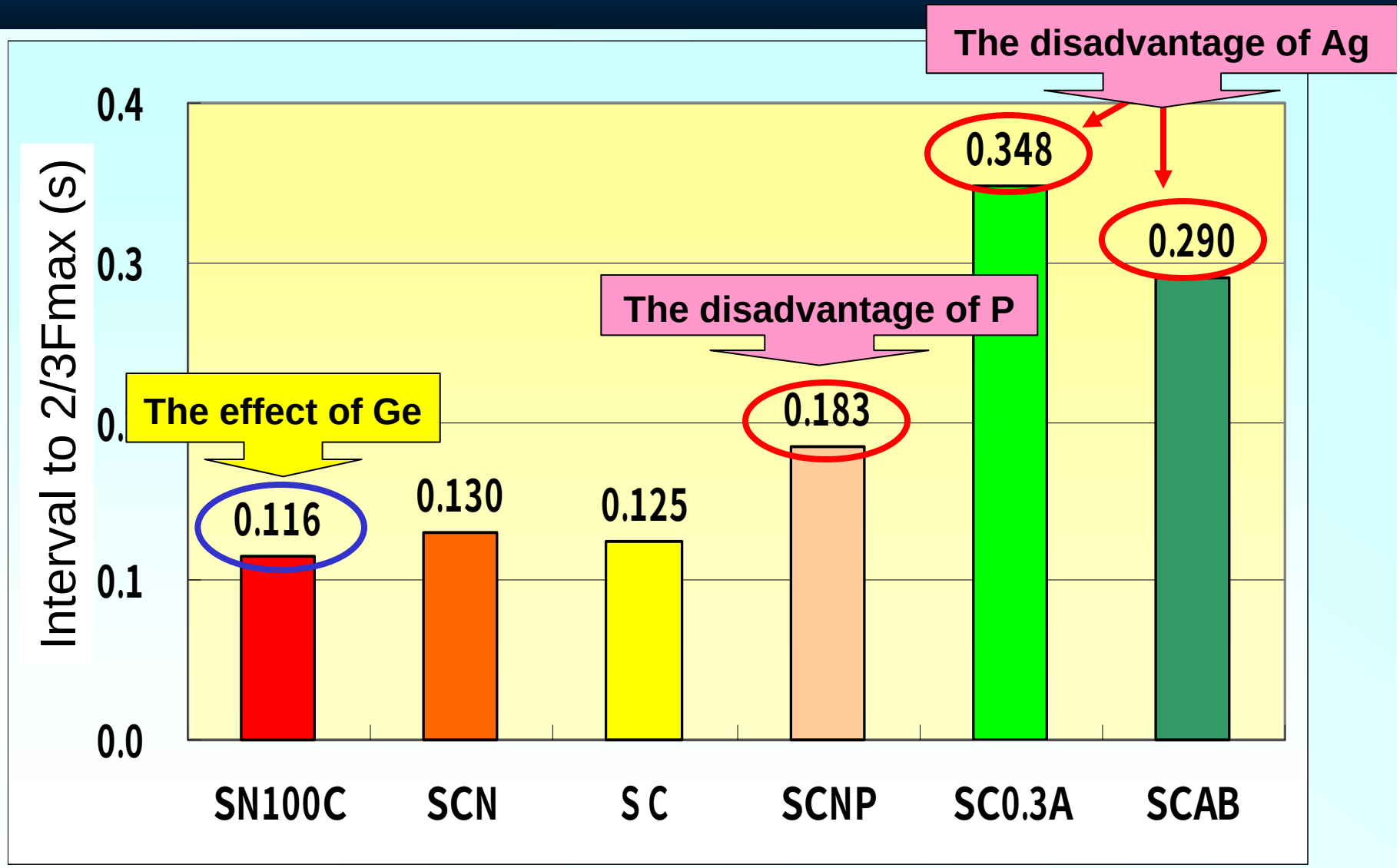
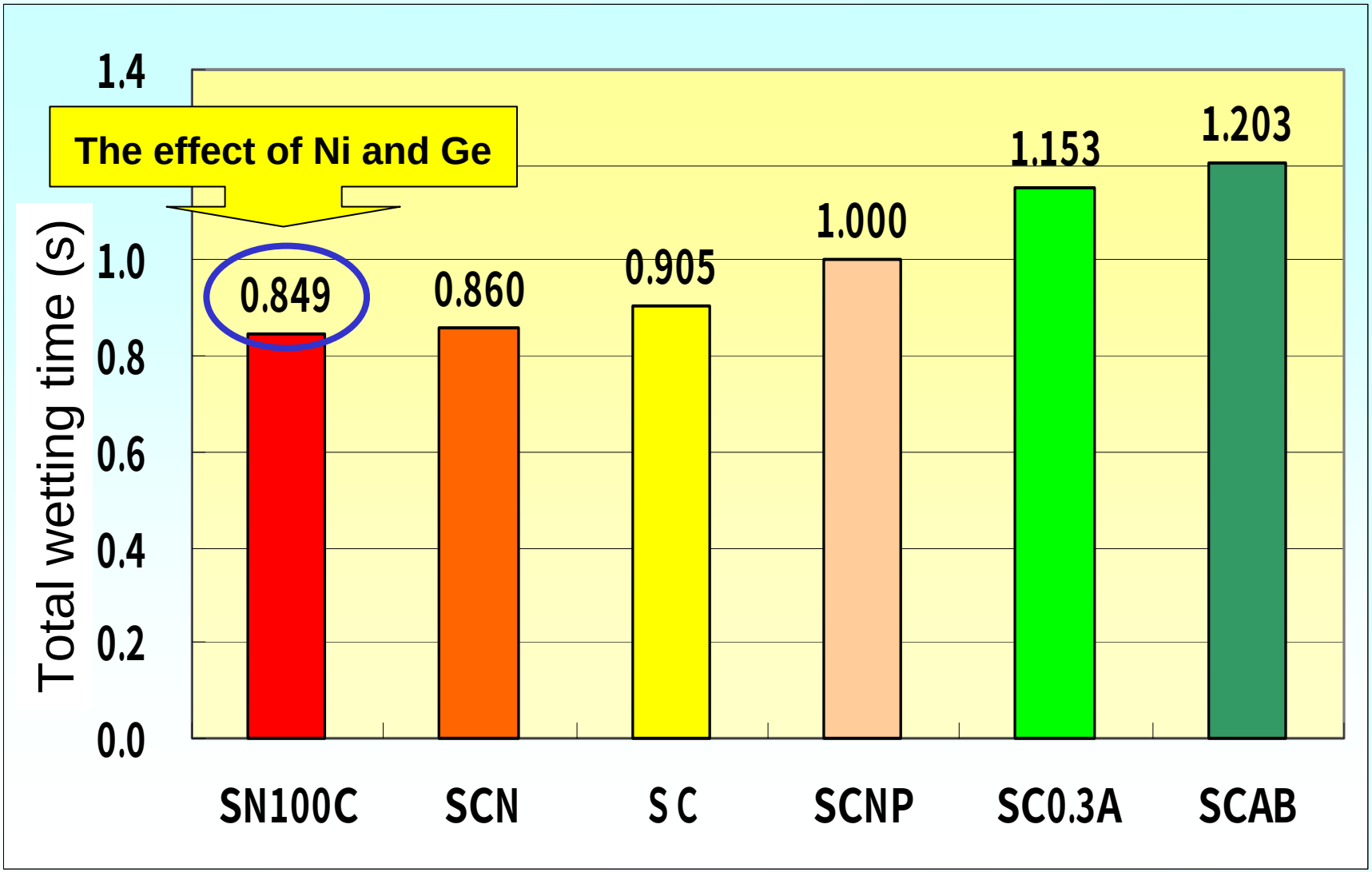
Interval to 2/3Fmax



Total wetting time



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The effect of Germanium additions

III- The reduction of dross generation

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Method of measuring dross rates

1. Desk-top mini-wave solder pot

- Solder capacity: 7kg
- Bath dimensions: 130mm x 150mm
- Nozzle dimensions: 30mm x 30mm
- Fall distance from the jet outlet to the surface of the bath: 35-40mm

2. Melting temperature: 255℃

3. Precondition the bath by operating for 30minutes in air
   at constant pump speed.
   Remove the dross generated this preconditioning.
   Start the test with the preconditioned solder bath.

4. Collect the dross every hour for 4hours and weigh.
   Calculate the quantity of dross per hour for each alloy.

The images of dross

Sn-3.0Ag-0.5Cu	Sn-0.7Cu	Sn-0.7Cu-0.05Ni	SN100C Sn-0.7Cu-0.05Ni+Ge
			
			

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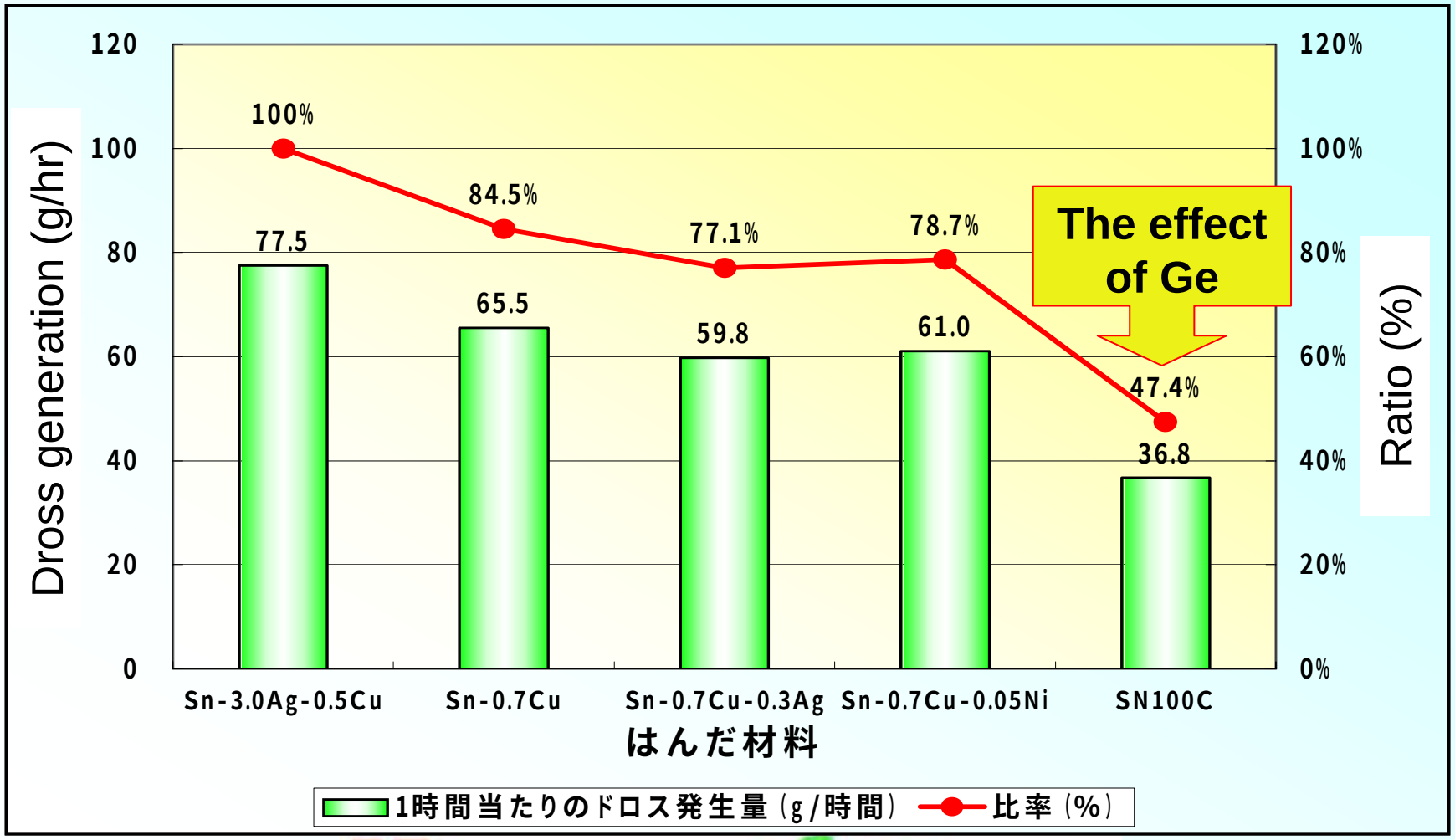
Dross generation

The dross generation of SN100C is half as much as that of SAC305.



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Summary of the effect of Germanium additions

The effect of Germanium additions

I Bridge elimination

The beneficial effect of Ge on drainage combined with the beneficial effect of Ni on fluidity ensures minimum bridges.

II Faster wetting

The Ni addition accelerates initial wetting and the Ge addition accelerates wetting after zero-crossing.

III Reduced dross generation

The thin film that Ge forms on the surface of solder bath reduces the formation of the tin oxide that is the basis of dross.

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