Sumitomo Heavy Industries, Ltd.

Sumitomo Heavy Industries, Ltd. (SHI)

Name : Sumitomo Heavy Industries, Ltd.

Head Office : Tokyo, Japan

Founded : November, 1888

Capital : JPY 30.8 billion

Employees : Consolidated - 11,149

(Non-Consolidated – 2,840)

Net Sales : Consolidated - JPY 551billion (FY2005)

(Non-Consolidated - JPY 266billion)

History

Period	Event
April 2001	NEC Automold Business was Transferred to SHI and SHI founded Synex Corporation as 100% share holder
June 2001	Synex Started Manufacturing and Sales Operation
June 2002	Toshiba's Automold Business was transferred to Synex
October 2002	Moved to New Factory at SHI Yokosuka Shipyard
August 2005	Synex obtained ISO9001:2000 Certification
April 1, 2006	Synex was absorbed in Sumitomo Heavy Industries Ltd.

Major Customers

Country	Name
Japan	NEC Electronics and subsidiaries
Japan	Toshiba Semiconductor and subsidiaries
Japan	ASE Japan
Philippines	TI Philippines
Singapore	NEC Semiconductors Singapore Pte Ltd
Malaysia	NEC Semiconductors(Malaysia) Sdn.Bhd.
Malaysia	Toshiba Electronics Malaysia Sdn.Bhd.
Taiwan	Powertech Technology Inc.
Taiwan	Walton Advanced Engineering Inc.
China	Shougang NEC Electronics Co., Ltd.
China	Toshiba (Wuxi)
China	GAPT

SHI Electro-Mechanical System (Taiwan) Co., Ltd

住重電子機械科技(股)有限公司

設立　:　2000年10月

本社　:　台北県三重市(台湾)

業務　:　雷射鑽孔機、封止装置、維修/備料提供

簡介　:　台湾人 工程師８名、中国拠点６名, Singapore 2名

2000年起、住友重機械上海有限公司設立(上海市)

2002年起、深土川(広東省)、事務所設置

→2006年底、現地法人設立予定

2004年起、昆山市(江蘇省)、事務所設置

2005年、Singapore事務所設置

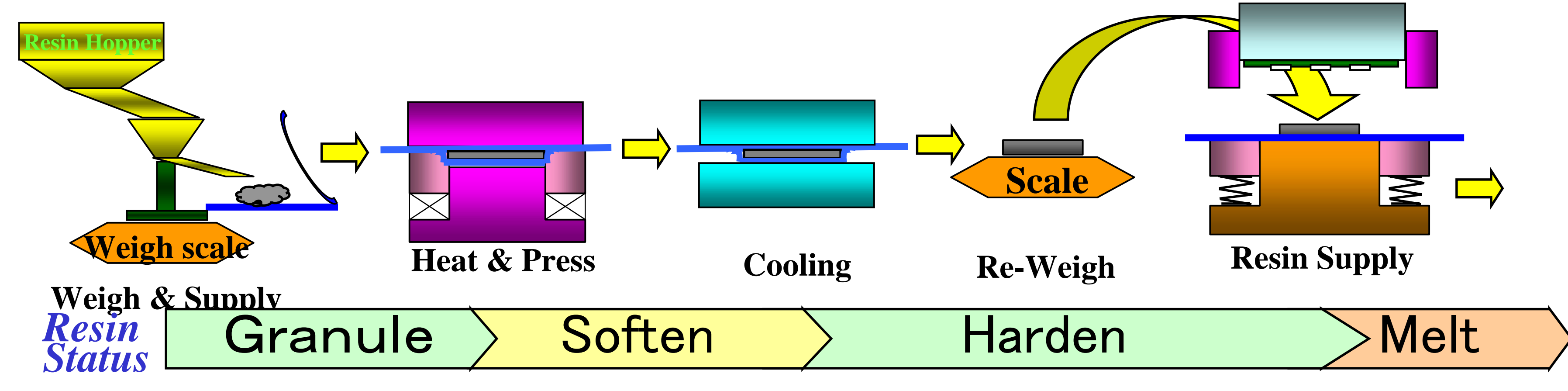
2007年、北京/天津地区事務所設立計画中

SHI's Compression Molding (COMP 30A2)

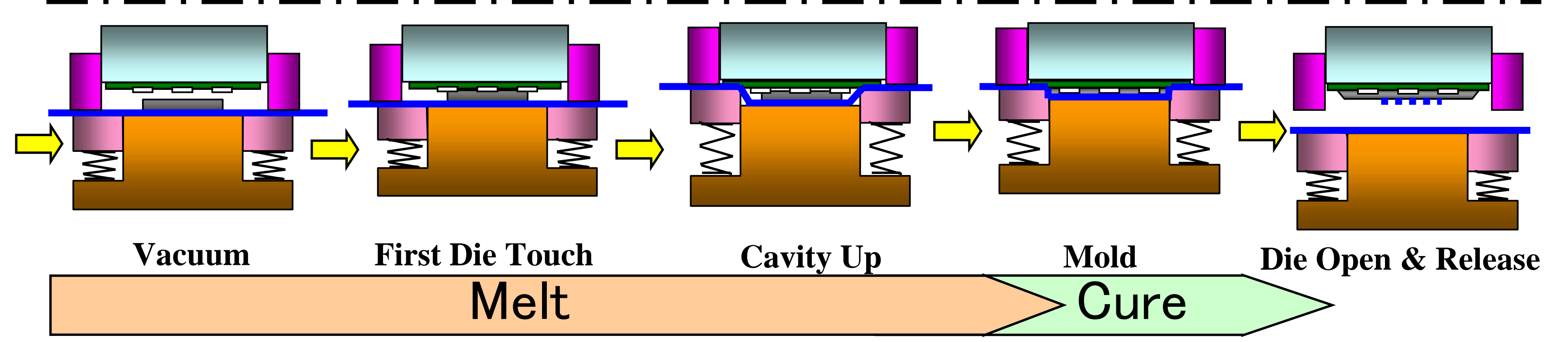
Machine Layout

What is compression mold ? (SHI専利)

Synex



Resin Status



5-Speed Control
3-PressureControl

Advantage of Compression Mold
Wire Sweep低減

Wire Sweep can be minimized in normal resin (Viscosity≒25Pa･s)

Wire Length
6.5mm

Compression
Resin Flow 0.2mm/s
Viscosity≒25Pa･s

Transfer
Resin Speed 5mm/s
Viscosity≒5Pa･s

Deformation %

14.0
2.0
0.0
8.0
6.0
4.0
2.0
0.0

14 16 18 20 22 24 26 28 30

Wire Dia (μm)

In compression mold, we can use very low molding speed (ex. 0.2 mm/s)

⇨ **Advantage to Long & Thin Wire**

Point of Design for SHI Molding Machine is:

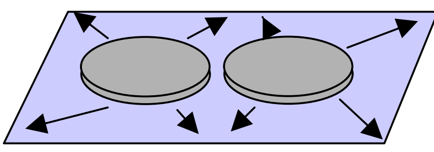
→ Supply of high quality PKG by Compression Mold

Quality	Point of Process	Advantage of SHI's machine
1) Wire sweep	To minimize wire sweep	Pre-form resin size ≒ Cavity size
	Uni formity for viscosity of resin	Uniformity of viscosity by keeping viscosity of temperature of resin of cavity.
	Molding in slow velocity	High precise molding press (min. 0.01mm/s)
2) Void	Vacuum Molding	Optimizing vacuum molding precess
	Dehumidity	Dehumidity in heating of pre-form process
3) PKG thickness	Weight control of pre-form resin	Calculate required resin quantity by counting
	Keeping balance of mold die	number of chips in Image Process
4) Cleaness	Not leaking resin outside of substrate	Keeping accuracy of PKG thickness by controlling the weight of pre-form resin
	To avoid scatter of resin in pre-forming process	Pre-forming the resin laminated with film

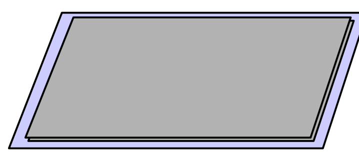
Why is Pre-form Resin effective for Wire Sweep ?

	Tablet（Coin shape）	Pre-form	Granule
Wire Sweep (Worst) Gold Wire 3.5mm (Dia 28μm) Long Gel Resin	5%（Max)	1%(Max)	10%(Max)

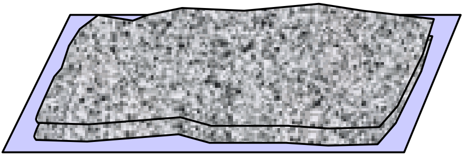
Pre-From Resin is the best way against Wire Sweep !!



Tablet(Coin shape)
(Resin flow)



Pre-form



Granule
(Resin Temperature Ununiformity)

＜Benefit of Pre form Resin＞
Resin melts equally. It's impossible for granule resin.
＜Pre-form resin size＞
Resin pre-form size is nearly equal with cavity size.

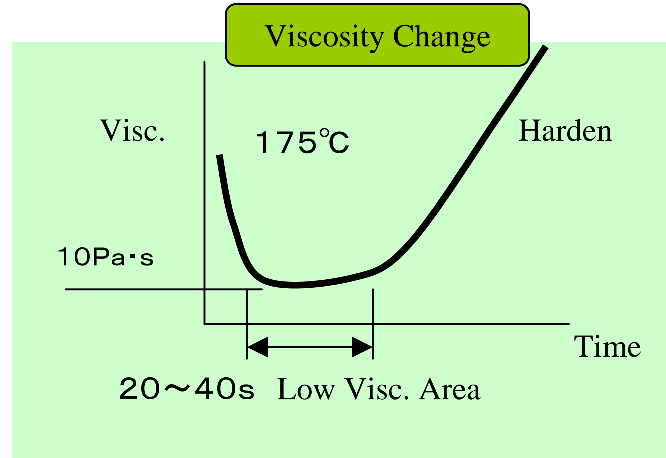
Evaluation of each Resin Form

Wire : Length 3.5mm , $\phi 28 \mu m$

Tablet(Coin shape)	Pre-form	Granule

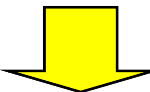
SHI CONFIDENTIAL

Why is Pre-formed Resin effective for Resin Flow ?

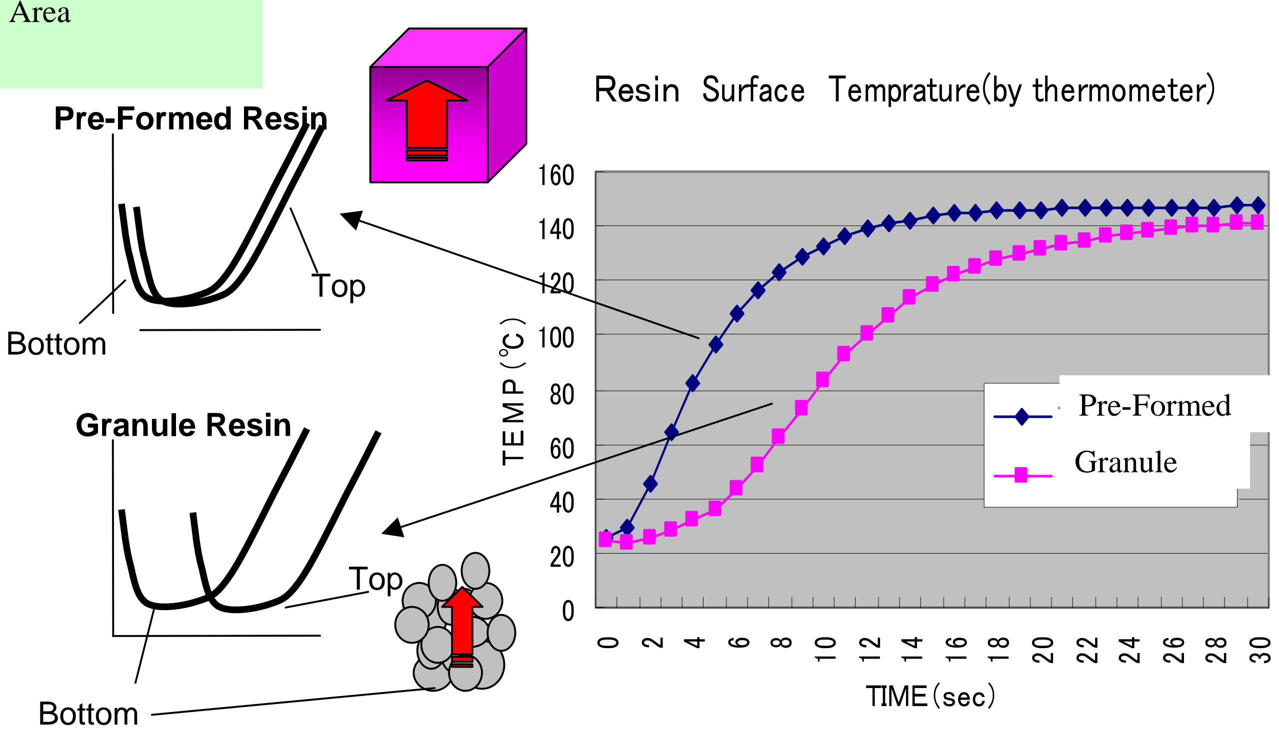


Compare Temp.between Pre-formed and Granule Resin at Resin Feeding

Temp. Difference at Molding Die and Surface of Resin



Temp Difference causes Resin Flow Conditions



Comparison with competitor A

Resin Shape	SHI : Pre-formed Resin	Granule Resin
Molding Idea		
Cost of Resin	1	1
Unformity of Temp. (Wire Deform, Filling)	○	×
Resin Flow (Wire Deform)	○	△
Air Exhaust (Void)	○	○
Cleaness of Processing (Irregular Damage)	○	×

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	Uni formity for viscosity of resin	Uniformity of viscosity by keeping viscosity of temperature of resin of cavity.
	Molding in slow velocity	High precise molding press (min. 0.01mm/s)
2) Void	Vacuum Molding	Optimizing vacuum molding precess
	Dehumidity	Dehumidity in heating of pre-form process
3) PKG thickness ±25μm	Weight control of pre-form resin	Calculate required resin quantity by counting
	Keeping balance of mold die	number of chips in Image Process
4) Cleaness	Not leaking resin outside of substrate	Keeping accuracy of PKG thickness by controlling the weight of pre-form resin
	To avoid scatter of resin in pre-forming process	Pre-forming the resin laminated with film

How to control PKG Thickness & Accuracy (3/3)

Image Process
(Counting No. of Die)

Loader / Unloader

Resin Feed
Unit

1700

Weighting
±30～90mg
(depend on
mold area)

Subst. Feed
Unit

2600

Film Assist
Unit

Press
Unit

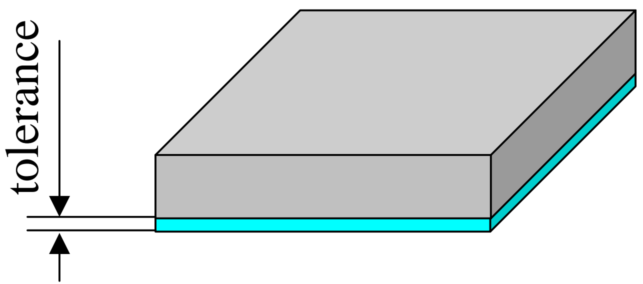
Precision Press
±10μm

Resin measure tolerance

Resin measure tolerance is depend on the preform size and package thickness tolerance.

Weight = Volume（Thickness tolerance ＊ Area）

＊ Specific Gravity（比重）



［mg］

Thickness［μm］	Preform（PKG）size［mm＊mm］ 20x20	40x40	80x80	80x160	80x240
5	4	16	64	128	192
10	8	32	128	256	384
15	12	48	192	384	576
20	16	64	256	512	768

Actual Data of PKG Thickness

PKG Size
188 x 56 mm
Large Size Mold in One shot

Control Zone

Control Zone

PKG Thickness (μm)

No. of Shot

PKG Thick Max

PKG Thick Min

850
840
830
820
810
800
790
780
770
760
750

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Exterior

Road map

Packaging Road Map

	1990			2000					2010	
PKG Thickness(mm)	3	1	0.5	0.4	0.3	0.2	0.15	0.1 ･･･		
PKG Width(mm)	30		50		75		100	120	150 ･･･	
No.of Chip stack	1			2	5	7 ･･････				
Wire Length(mm)	4		5		6	8	10 ････			
Wire Diameter（μm）	25				20	18	15 ････			

Multi Plunger Transfer Area

Transfer & Compression Mold Area

Compression Mold Area

Conventional Transfer Area

SiP

Wafer Level CSP

PBGA
(Plastic Ball Grid Array)

パッケージ積層

QFP
(Quad Flat)

SOP
(Small Outline)

DIP
(Dual Inline)

Single Chip → Multi Chip(SiP)

- SingleChipe
- Chip Thickness over 0.2mm
- Wire Dia over22μm

- Multi Chip
- Thin and long wire
- Multi Stack
- Very ThinPKG

Molding Machine Road Map

			2005	2006	2007	2008	2009	2010
Market Needs	Application		SiP BGA WCSP	⇨	⇨ +PoP +PiP	PoP	Chip on Chip	⇨
	Packaging Technology	Wire Length	5.5mm	5mm				
		Wire Diameter	25um	23um	20um	18um		15um
		Pad Pitch(千鳥)	50um		40um		30um	
		Bonding Methid	Wire Bonding			Flip Chip		
		Die Thickness	70um	60um	50um	40um	30um	20um
		Die Stack	5	7	9		12	
		PKG Thickness	1.2mm	1.0mm		0.5mm		
		Chip Condensar	0603		0402			
		Sub Thickness	100um		70um		50um	30um
Products		Major use(Market)						