

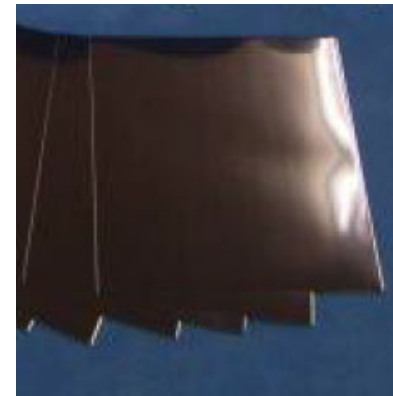
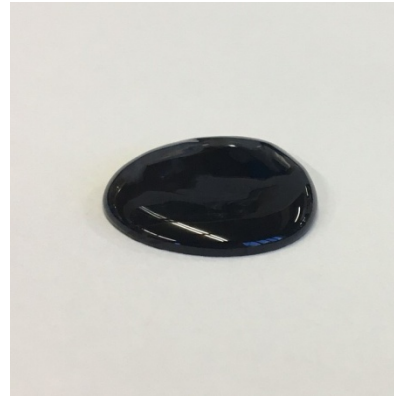
# Molding Compound Technology

May. 30<sup>th</sup> 2019

E. Nomura  
Nagase Chemtex Corporation

Material Type		Encapsulant for WLP			
		Mold		Laminate	Print
		Transfer	Compression		
Tablet		Applicable			
Granule			Applicable		
Sheet			Applicable	Applicable	
Liquid			Applicable		Applicable

Compression mold process is standard for Wafer-Level encapsulating process



Liquid

Sheet

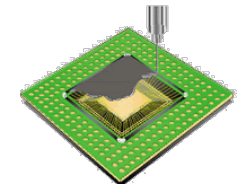
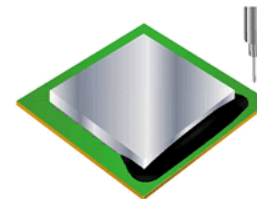
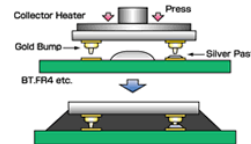
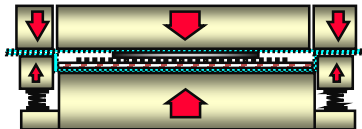
**Process**

Compression

Under Fill

Under Fill

Potting



**Products**

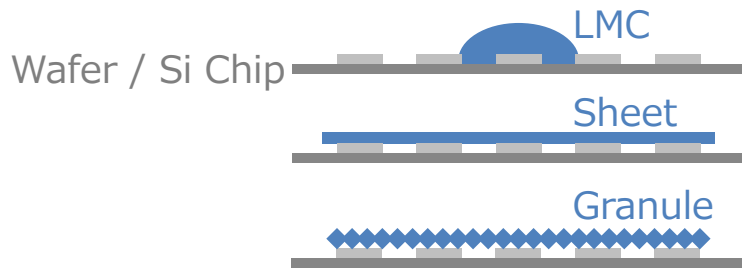
**Molding Compound**

NCP, NCF  
Non Conductive  
Paste & Film

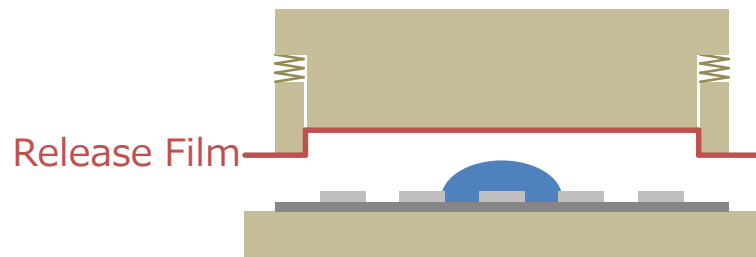
CUF  
Capillary  
Under Fill

GT  
Glob Top

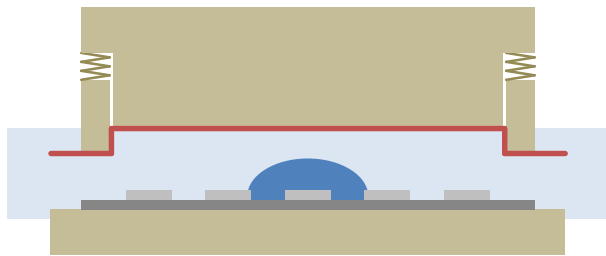
## 1. Dispense



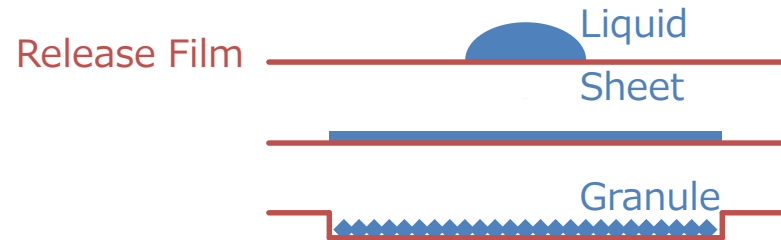
## 2. Set



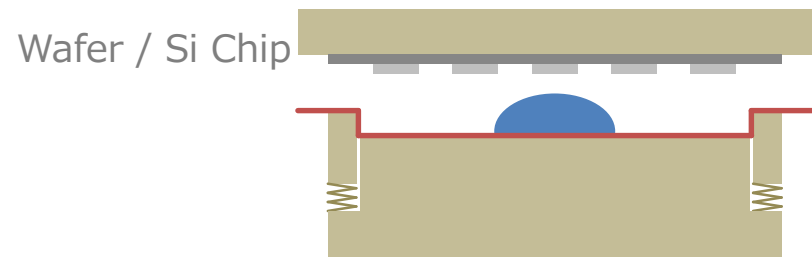
## 3. Vacuum



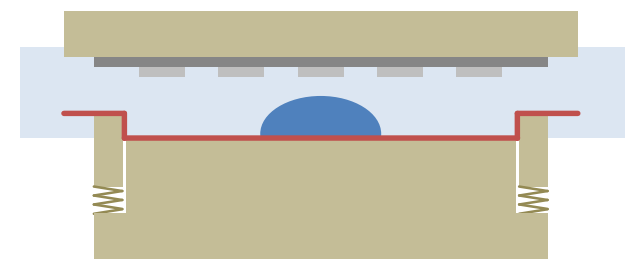
## 1. Dispense



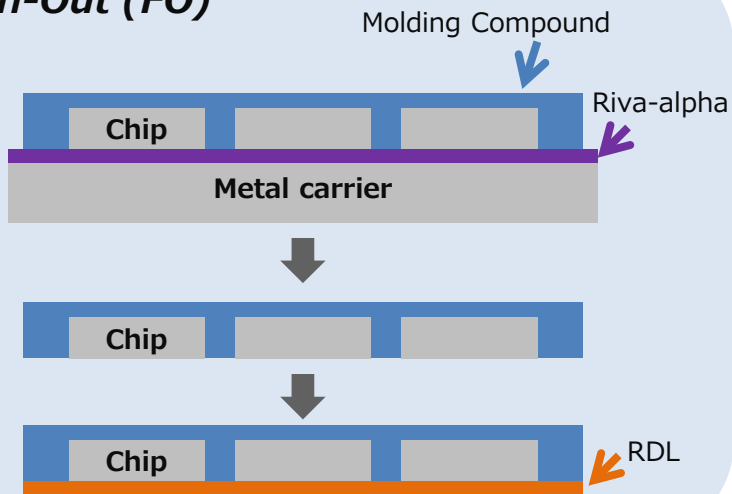
## 2. Set



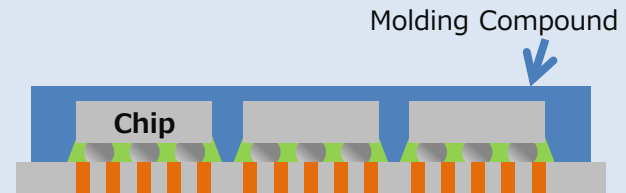
## 3. Vacuum



## Fan-Out (FO)

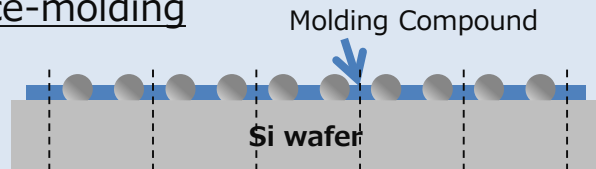


## Chip on Wafer (CoW)

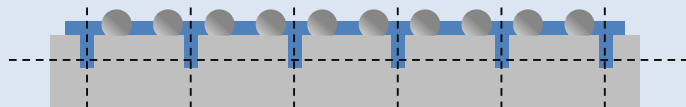


## Bump protection

### 1-face-molding

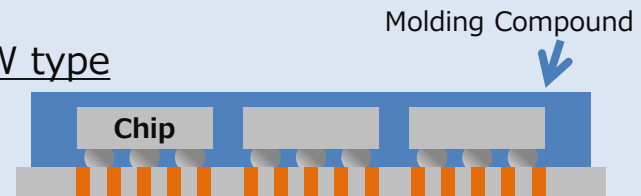


### 5-face-molding

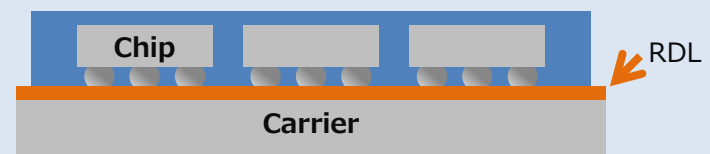


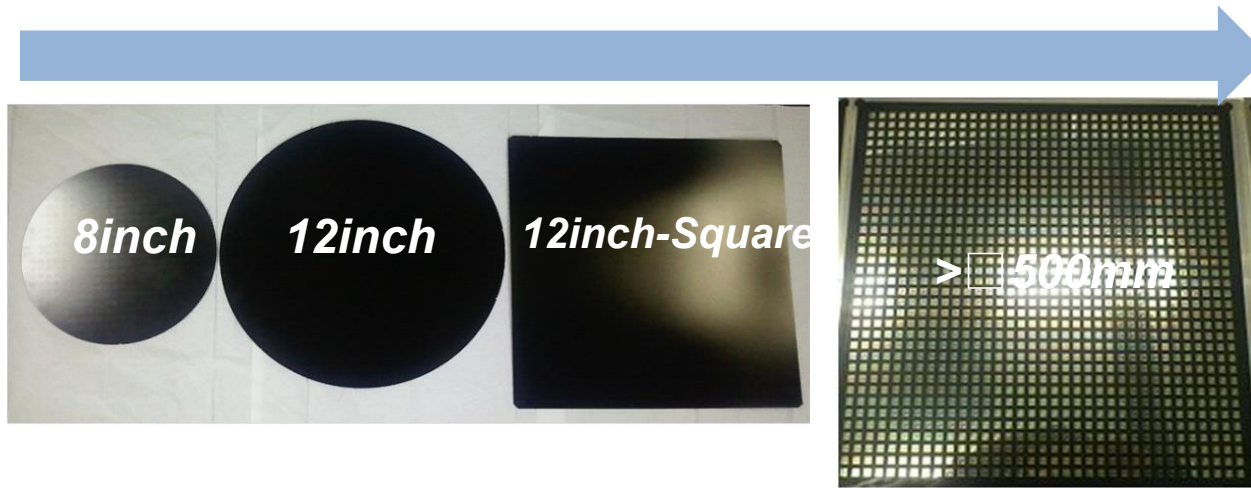
## Mold Under Fill (MUF)

### CoW type

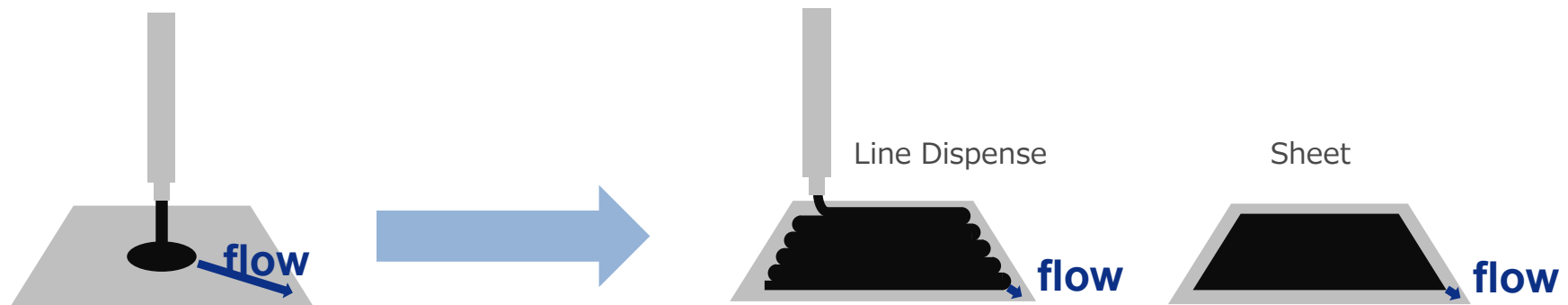


### RDL first





There is a trend for large area PLP process in terms of process cost reduction  
But still there are some difficulties about warpage, die-shift, fine L/S and infrastructure



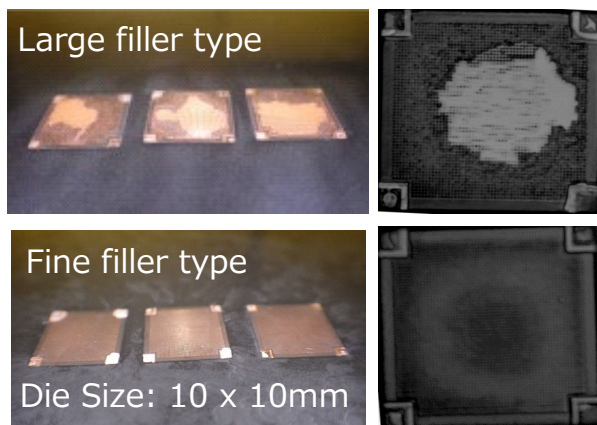
Dispense method or material needs to change for PLP  
Line dispensing system and Sheet achieves homogeneous surface molding

# Material Roadmap of FOWL

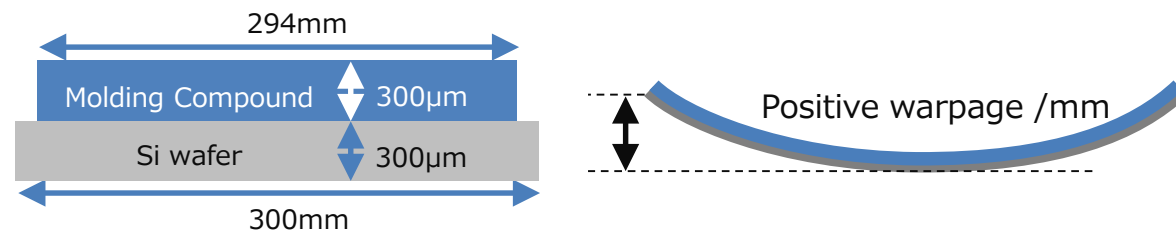
Package Type	Package Trend	LMC Requested Trend	Release Year	Target Properties (Current / Future)
Chip first, Face-down FO	Low Cost	Low Cost	-	-
Chip first, Face-up FO	Fine RDL Large Die Large Package	<b>Low Warp</b>	<b>2021</b>	<b>Warp<sup>*1</sup> (30mm / 5mm)</b>
		Fine Filler for Fine RDL	2021	Filler Top Cut Size (25 $\mu$ m / 10 or 5 $\mu$ m)
		Low Cost	2023	Price (--- / Approx. 1/2)
RDL first, Face-down FO	Large Die Large Package	Warpage Balance with RDL Layer	2019	(--- / ---)
		<b>Mold Under Fill</b>	<b>2023</b>	<b>Underfill ability (Void / No void)</b>

\*1 12inch Si wafer in the structure LMC(300 $\mu$ m)/Si(300 $\mu$ m)

## Mold Underfillability



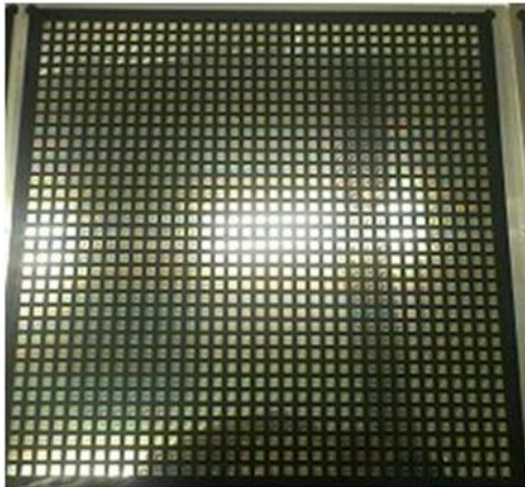
## Warpage Measurement Structure



Package Type	Package Trend	LMC Requested Trend	Release Year	Target Properties (Current / Future)
All Type of Fan-Out Si bridge	Fine RDL Large Die Large Package Low Cost	<b>Low Warpge</b>	<b>2020</b>	<b>Warpage*<sup>1</sup> (30mm / 5mm)</b>
		Fine Filler for Fine RDL	2020	Filler Top Cut Size (25μm/ 10 or 5μm)
		<b>Thin Molding</b>	<b>2020</b>	<b>Thickness (500μm / 50-150μm)</b>
		Low Cost	2025	Price (--- / Approx. 1/2)

\*<sup>1</sup> 12inch Si wafer in the structure LMC(300um)/Si(300um)

500x500mm PLP Fan-Out



The panel size over 500mm square is evaluated as the standard panel size.

Low warpage and thin molding are the typical requested properties for LMC in Panel Level Packaging process.



# Standard MC Properties

Item	Unit	R4212	R4511	R4604	X0017	R4724
Application		Fan-Out		CoW		BP and MUF
Feature		Standard FO	Printing	Low warpage	Sheet	Fine filler for BP
Filler content	%	89	87	87	75	76
Filler top cut	μm	75	25	25	20	10
Filler average size	μm	21	8	8	8	2
Specific gravity		2.02	1.98	1.98	1.8	1.81
Viscosity	Pa·s	600	450	650	-	35
Flexural Modulus (25°C)	GPa	22	20	19	13	11
Tg (DMA)	°C	165	160	160	150	170
CTE1	ppm/K	7	9	7	29	17
CTE2	ppm/K	30	38	22	-	68
IMC condition		125°C/10min	125°C/10min	125°C/10min	125°C/10min	125°C/10min
PMC condition		150°C/60min	150°C/60min	150°C/60min	150°C/60min	150°C/60min

**FOR the FUTURE**  
私たちは豊かな未来のために化学する



<http://www.nagasechemtex.co.jp/>