Packaging and assembly made simple with Vapor Deposited Eutectic Solders

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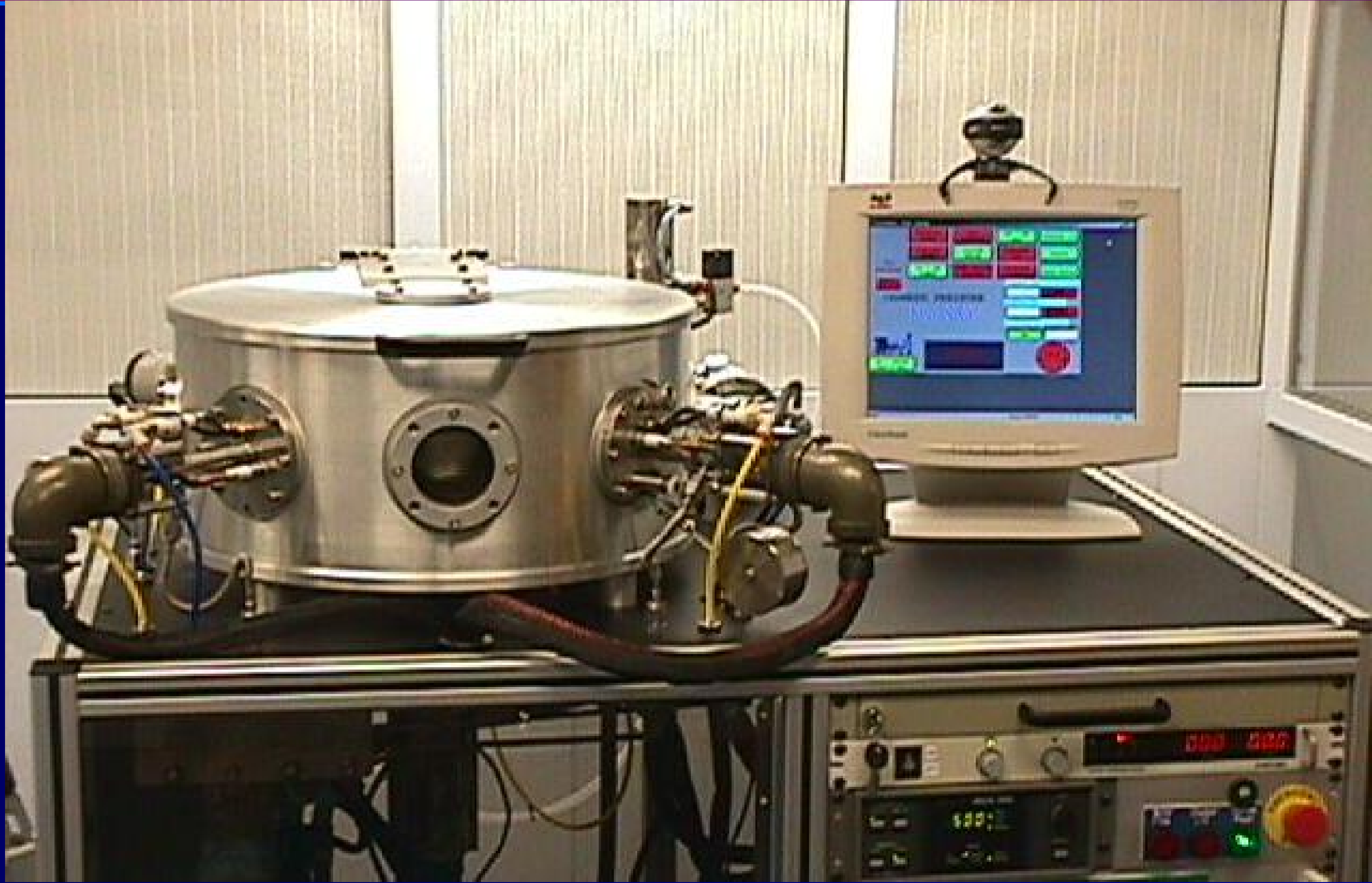
Vapor deposited eutectic solder

- What is it?
- How does it work?
- What solders can be vapor deposited?
- What solders cannot (should not) be vapor deposited?
- Solder hierarchy
- Advantages
- Disadvantages
- Other solder deposition methods

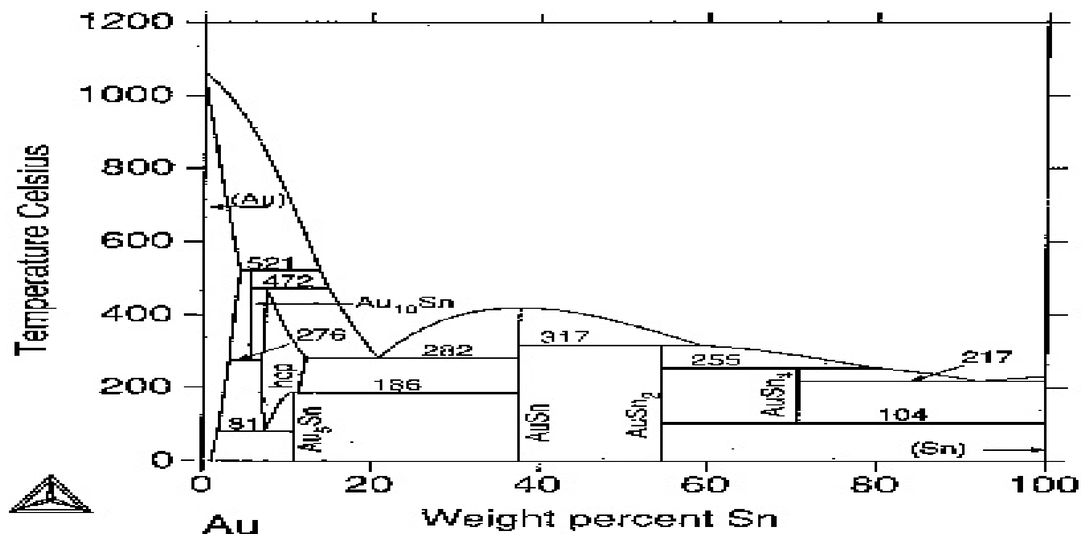
Vapor Deposition System



Brazing And Solder Compostions

SOLDER	LIQUIDUS °C	SOLIDUS °C	Stellar Vapor Deposited
CuSil - Copper Silver 28/72	780	eutectic	
InCuSil-5 5/27/68	760	743	
InCuSil-10 10/27/63	730	685	
AuSi - Gold Silicon	363	eutectic	
AuGe - Gold Germanium	361	eutectic	
AuSn - Gold Tin 70/30	390	278	yes
AuSn - Gold Tin 73/27	370	278	yes
AuSn - Gold Tin 75/25	356	278	yes
AuSn - Gold Tin 80/20	278	eutectic	yes
AgSn - Silver Tin 3.5/96.5	221	eutectic	yes
SnPb - Tin Lead 60/40	191	183	
SnPb - Tin Lead 70/30	186	183	
SnPb - Tin Lead 63/37	183	eutectic	
SnPbAg - Tin Lead Silver 62/36/2	179	eutectic	
InPb - Indium Lead 70/30	171	162	
SnPbCd - Tin Lead Cadmium 51.2/30.6/18.2	145	eutectic	
InAg - Indium Silver 97/3	143	eutectic	
BiSn - Bismuth Tin 58/42	138	eutectic	
InSn - Indium Tin 50/50	125	118	
BiPb - Bismuth Lead 55.5/44.5	124	eutectic	
InSn - Indium Tin 52/48	118	eutectic	
The above information is generic in nature and not supplier specific			

SGTE Phase diagram collection



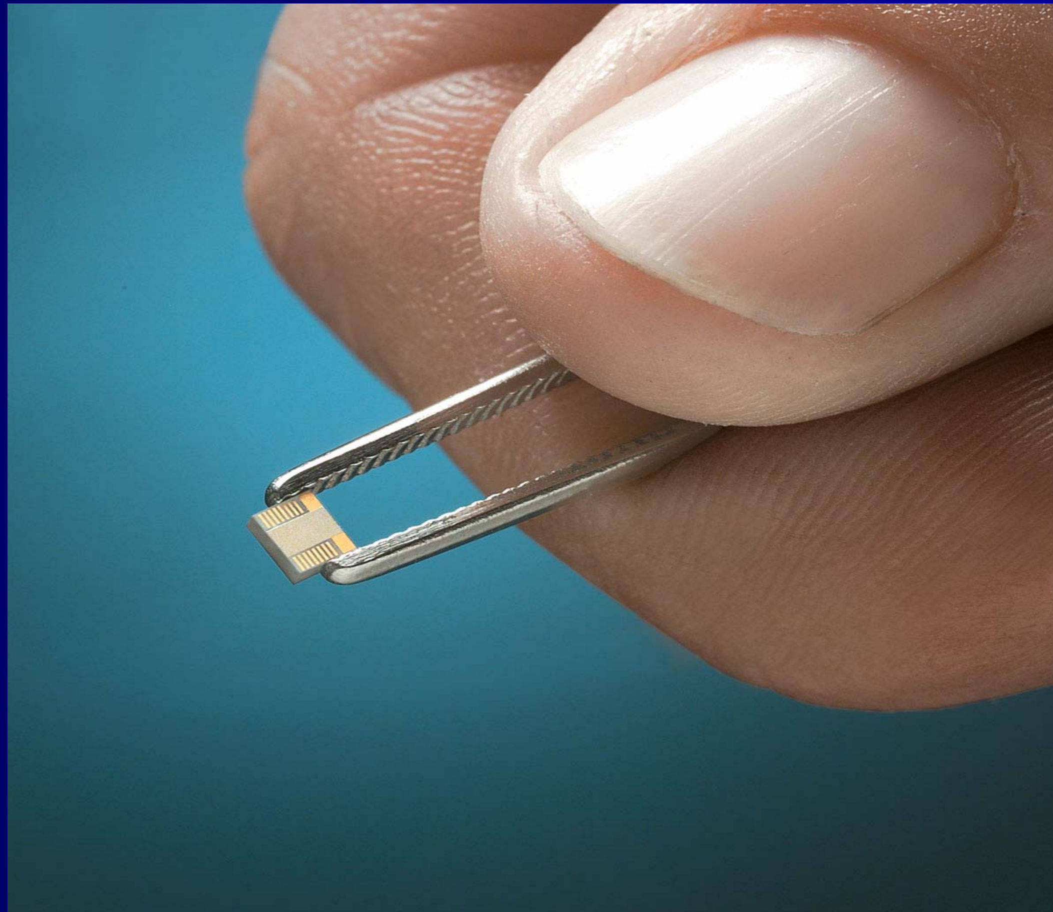
Au-Sn Crystal Structure Data

Phase	Pearson Symbol	Struktur Bericht	Prototype	Model
(Au)	cF4	A1	Cu	RK
$Au_{10}Sn$	hP16	$D0_{24}$	Ni_3Ti	CE
hcp	hP2	A3	Mg	CE
Au_5Sn	(a)			CE
AuSn	hP4	$B8_1$	AsNi	CE
$AuSn_2$	(b)			CE
$AuSn_4$	oC20	$D1_c$	$PdSn_4$	CE
(Sn)	tI4	A5	βSn	RK

P-Y Chevalier, Thermochimica Acta, 130 (1988) p 1-13

Thin Film Metalized Substrates and 4″ Diameter Wafers (in frames) to be coated with vapor deposited 80/20 AuSn

AlN submount thin film metalized with Ti/Pt/Au followed by 'selective' area with 3-5 μm of vapor deposited Au/Sn



Advantages

- Solder composition ± 1%
- Various solder compositions: 80/20 – 75/25 – 73/27 - 70/30
- Thin layers - 2µm to 10µm
- Low temperatures @ deposition
- Liftoff photo resist can be utilized
- Blanket coverage on backside of wafers
- Cost savings @ production quantities
- Virtually eliminates the possibility of voiding

Disadvantages

- Liquidus temps for 75/25, 73/27 and 70/30 are high
- Thin layers - not a good filler
- Cost in prototype quantities

‘Other” Solder Deposition Methods

- Standard - preform materials
- E–Beam evaporation – Dual source deposition
- E-Beam evaporation – Layering
- Sputtering - from a single source
- Sputtering - Layering

Conclusion

Packaging and assembly can be made simple with vapor deposited solders. There are advantages and disadvantages to all the fabrication processes. Your final needs will dictate whether this process fits your particular situation or not.

It can certainly enhance the uniformity of the solder joints and virtually eliminate voiding. The blanket deposition on the back of wafers eliminates the need for placing solder pads on the substrates either with a preform or with a deposited process. Once coated with solder, the wafer can be diced or scribed to chip size and then pick and placed wherever it is to be mounted with vapor deposited solder already on the face of the chip.