底部填充与灌装粘合剂

Underfills and Encapsulants

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美国联合粘合剂公司(United Adhesives Inc)所研发生产的底部填充与灌装粘合剂以环氧树脂为基体的底部填充与灌装粘合剂(Underfill)主要应用于半导体工业，诸如裸芯片，晶片，BGA，flip-chip，CSP等的粘合或灌装，产品的高流动性使其用来填充芯片和底座间的空隙，或者用来将整个部位进行灌注或者覆盖。

产品具有以下特征：
- 优越的毛细流动能力。
- 高玻璃转化温度(High Tg)，具有高温稳定性。
- 很低的热膨胀系数(CTE)以减少热应力。
- 对高电压有优良的绝缘能力。对低电流有良好的防漏损能力。
- 对FR4，陶瓷，polyimide，金属和其他较难粘结的材料亦有良好的粘结性。
- 本公司同时也提供兼有导热能力的底部填充粘合剂。

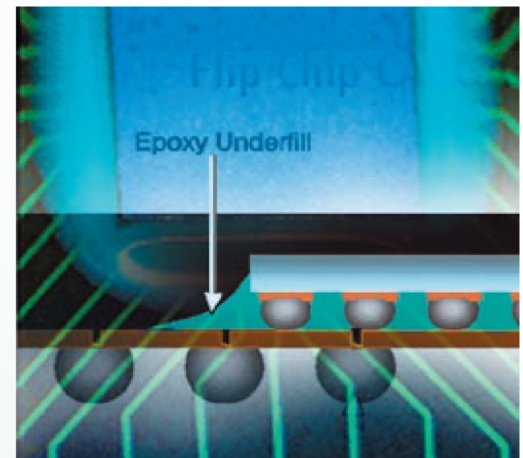
Epoxy based underfill and encapsulant products from United Adhesives are for semiconductor applications such as to attach chip-on-board, bare die, BGA, flip-chip, CSP, etc, or to under-fill the gap between die /chip and substrate, or to encapsulate dies, chips, components, or powder devices.

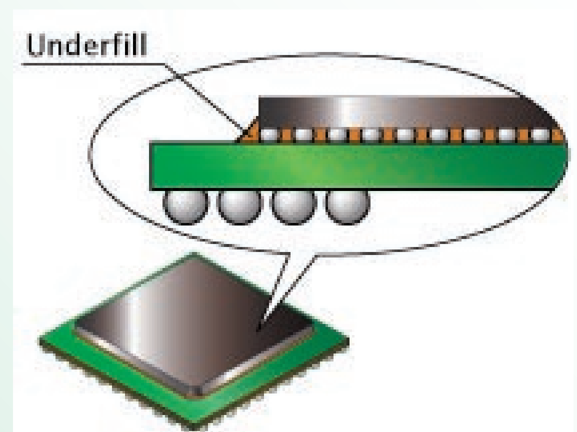
They provide various superior features such as:
- Excellent capillary flow capability.
- High Tg formulation for high temperature stability.
- Very low CTE formulation to minimize the thermal mismatch.
- High voltage insulation formulation.
- Strong bond to FR4, ceramic, polyimide, metals, and other difficult materials.
- Good dielectric property. Low current leakage.

Thermally conductive underfills are also available.

一些典型的底部填充与灌装粘合剂列于下表
Some typical underfills and encapsulatants are listed in following table

Applications	Products	Features / Advantages
Flip chip, BGA underfill	TUF1210 UF1230 UF1240 SE1260	Thermally conductive underfill Fast flow with low CTE low alpha emission Underfill with rubber toughen for high strength Flexible / soft underfill
Die attach	EP1637 EP1723 EP1678 Eposolder 6869	Snap cure in seconds, flowabe, 1-part Snap cure in seconds, non-slump, 1-part 2-part, room temperature curable epoxy Extremely high thermal conductivity k = 11 W/mK
Low CTE bonding and encapsulation	EP1640 EP1641 EP1641NS	2-part 1:1 mixing low CTE epoxy. Low T curable 1-part heat cure. High thermal stability 1-part non-slumping. High Tg
Flexible bonding & encapsulation	EP1346 EP1386 SE1262 BS8311 BS8460	2-part (2:1) flexible, room temp curable 2-part (1:1) flexible, room temp curable 2-part (1:1) flexible, heat cure 1-part silicone, heat cure 2-part silicone, room temp curable
Details of the properties these adhesives can be found on the website: http://www.unitedadhesives.com/underfill_pot.html		





▶ UF1230 技术参数和特点 Technical Datasheets and Features

性能 Property	单位Units	UF1230 (low CTE)	美国军标参考值 Reference value from MIL-I-16923H
材料化学特点 Material Chemistry		Epoxy, silica filler	Not Defined
组分Component		One	Not Defined
最大挥发物含量 Volatile content, maximum	Wt %	0.2	1.0
最低适用期在23℃ Pot life at 23C, minimum	min	24 hrs	30 – 45
最大粘度 Viscosity, maximum	cps	8,000	25,000
最小工作寿命 Working life, minimum	min	24 hrs	30
最大易燃性燃烧程度 Flammability, extent of burning, maximum	in	0.2	1.0
平均比重 Average specific gravity		1.67 +/- 0.02	+/- 0.1
最小平均硬度 Mean hardness, minimum	Shore D	90	75
最小平均拉伸强度 Average tensile strength, minimum	lb/in^2 (MPa)	9,800 (70)	7,000 (50)
最小平均伸长率 Average elongation, minimum	Percent	3.0	2.0
最大平均吸水率 Average water absorption, maximum	Percent	0.15	0.2
最小机械冲击 Mechanical shock, minimum	lb	N/A	3
最小平均缺口Izod冲击 Average notched Izod impact, minimum	ft-lb/in	0.5	0.3
最小热冲击 Thermal shock, minimum	Cycles	1000	10
最大平均热膨胀系数 Average thermal expansion coefficient, maximum	in/in/°C	$19x10^{-6}$ (< Tg) $75x10^{-6}$ (> Tg)	$30x10^{-5}$
最小导热系数 Thermal conductivity coefficient, minimum	Cal cm/cm^2.sec°C (W/mK)	$4.8x10^{-4}$ (0.3)	$2.5x10^{-4}$ (0.11)
最小介电强度 Dielectric strength, minimum	Volts/mil	500	325
介电常数 Dielectric constant, maximum, At 60 Hz / At 1 MHz		4.0 / 3.5	5 / 4.5
耗散因数，最高在60赫兹频率为1MHz Dissipation factor, maximum At 60 Hz / At 1 MHz		0.01 / 0.01	0.04 / 0.05
最小耐电弧性 Arc resistance, minimum	Sec	3KV 60 sec, passed	50
最小体积电阻率 Volume resistivity, minimum	Ohm.cm	$1x10^{14}$	$1x10^{13}$
最大水解稳定性平均体积电阻率 Hydrolytic stability□ Average volume resistivity, maximum	Ohm.cm^2	N/A	
最小平均硬度 Average hardness, minimum	Percent reduction from control	N/A	10
真菌抵抗性 Fungus resistance		Grade 0	Grade 0
杨氏模量 Young's modulus	Gpa	7.6	Not Defined
玻璃化转变温度 Glass transition temperature	°C	150	Not Defined
α粒子发射量 Alpha particle emission	U (ppb)	< 0.2 ppb	Not Defined
离子含量 Ionic Content	(K^+, Na^+, Cl^-)	< 30 ppm	Not Defined
热稳定性 Thermal Stability	°C	-80 to 200	Not Defined
粘合力 Adhesion (Al/Al Lap Shear, psi)		> 1800 psi	Not Defined
固化条件 Cure Conditions 假如85°C， If 85°C 假如115°C，If 115°C 假如125°C，If 125°C 假如150°C，If 150°C	Minute	120 50 25 15	Not Defined

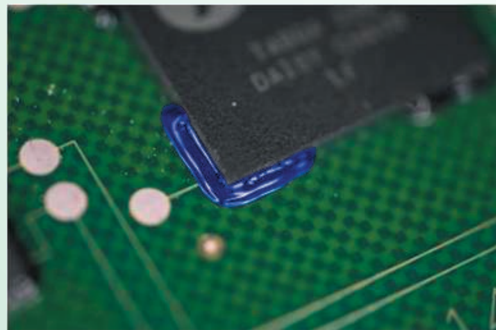
典型应用 Applications

尤其是我们的 UF1230 是环氧基的低热膨胀系数（CTE）的底部填充粘合剂。它是一种单组分，毛细流动制剂。在升高的温度下固化，对硅芯片，倒装芯片，BGA，陶瓷，FR4，低温共烧陶瓷，铝，铜，不锈钢等表面形成强力粘结，其非常低的热膨胀系数提供了较小的热应力和更好的热循环性能。

典型应用
•BGA的底部填充，裸芯片，倒装芯片，CSP
•芯片上的电路板粘合/密封
•模具粘接到各种基材，例如LTCC，HTCC，FR4 铝，铜等
•高度可靠的电子应用，如航空航天，汽车，军工等工业
•半导体和电信

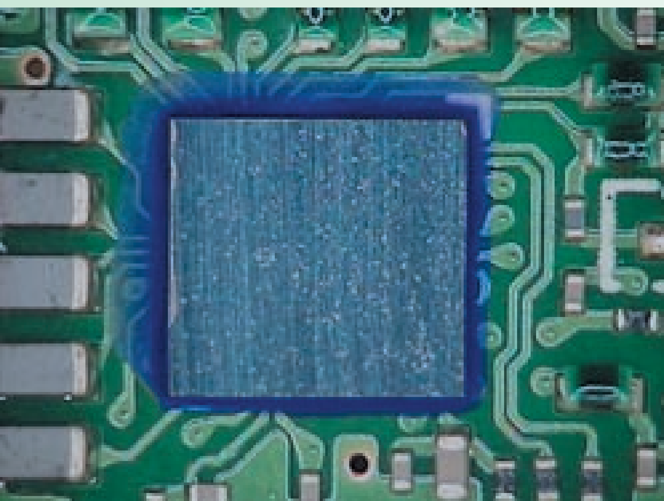
Specifically our UF 1230 is an epoxy-based low coefficient of thermal expansion (CTE) underfill. It is a one-part, capillary flow formulation that cures at elevated temperature to provide strong bonding to silicon, flip chip, BGA, ceramics, FR4, LTCC, aluminum, copper, stainless steel, etc. Its very low CTE formulation provides with minimized thermal mismatching stress and better thermal cycle performances.

Typical Applications
• Underfilling of BGA, Bare die, flip-chip, CSP
• Chip-on-board bonding / encapsulating
• Bonding of die to various substrates, e.g. LTCC, HTCC, FR4, Al, Cu, etc
• Highly reliable electronic applications such as in aerospace, automotive, and military, etc
• Semiconductor and Telecommunications

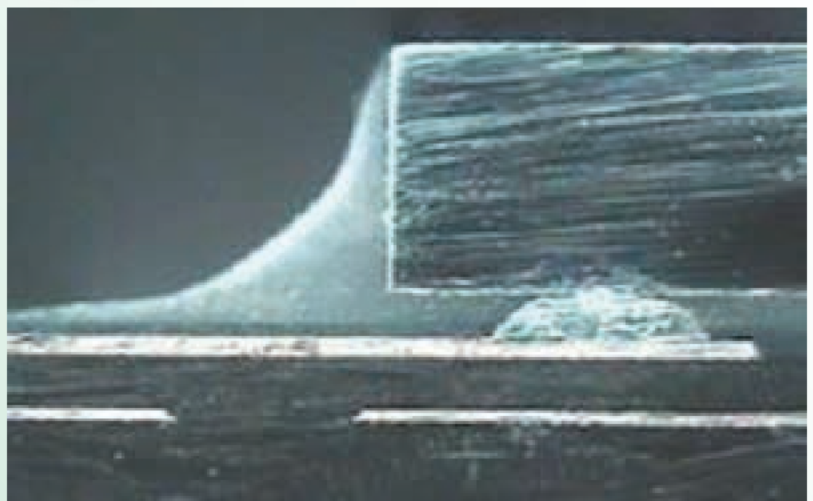


BGA芯片棱角底部填充后的显微照片
Microscope photo of BGA die after bonding around edge

本产品有10, 30, 55毫升注射器三种规格
There are 10, 30, 55 ml syringes available



芯片的底部填充 Die Underfilling



封装芯片断面SEM照片 SEM of cross-section of die

▶ 流程指南 Process Guidance

使用指导

有多种应用设备类型可以选用，包括：手工分配/时间压力阀;螺旋式的阀门;线性活塞泵和喷射阀。设备选型应以应用需求来决定。

1.确保在设备调置过程中，不要使空气进入到产品。
2.将充装产品的针筒自冷冻箱中取出，并在室温下解冻30分钟（通常情况下）。

3.为了获得最佳效果，基板应先预热（通常在90至100℃下进行预热约20秒），以允许快速毛细流动和促进流平性。其滴注喷嘴也可以预先加热（30至50℃,最大值）以进一步增加毛细流动。

4. 滴注产品以中等速度（2.5至12.7毫米/秒）。确保针尖离基材表面约0.025至0.076毫米，并从芯片边缘滴注 – 这将确保最佳的流动条件以保证能够底部填充。

5. 滴注模式是通常的“I”沿一侧或“L”图案沿两侧，最后在拐角处汇合。应用程序应该离芯片中心位置最处从开始滴注 – 这有助于确保芯片下方没有截留空隙。滴注的“L”或“I”的长度不应超过其对应芯片边缘长度的80%。

6.在一些情况下有可能需要作第二次,或第三次滴注。

7.对于低粘度的 UF1230，我们通常建议用紫色的21号（ID0.5，外径0.8mm）针头来用于滴注。不过，根据芯片的尺寸，间隙高度，以及希望填补多久，可以从22到15号调整针头大小。

8.按照TDS的固化条件进行固化。用较低的温度对应更长的固化时间是可行的。但是，客户需要做一定的测试和试用，以确保适当的较低温度德固化条件。

Application Guidance

A variety of application equipment types are suitable and include: hand dispense / time pressure valve; auger style valve; linear piston pump and jet valve. Selection of equipment should be determined by application requirements.

1. Ensure that air is not introduced to product during equipment set-up.

2. Pull the syringe from freezer and allow thaw at room temperature for 30 min (typically).

3. For best results, the substrate should be pre-heated (typically to 90 to 100 °C for about 20 seconds) to allow fast capillary flow and facilitate leveling. The dispense nozzle may also be pre-heated (30 to 50 °C maximum) to further increase capillary flow.

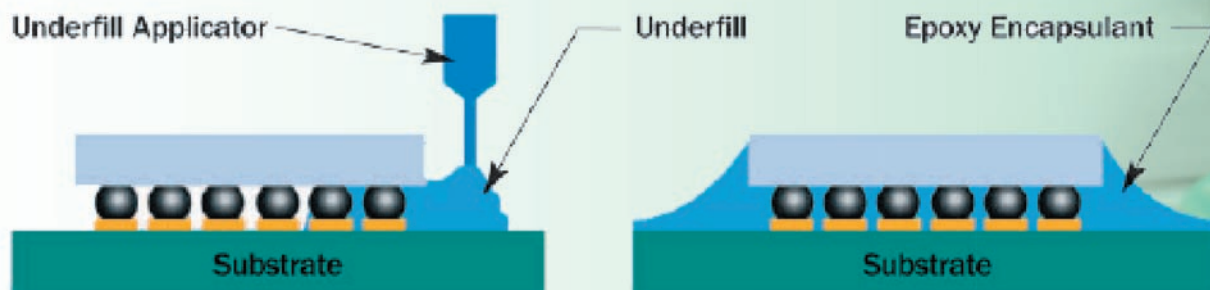
4. Dispense product at moderate speed (2.5 to 12.7 mm/s). Ensure that needle tip is about 0.025 to 0.076 mm from substrate surface and from chip edge - this will ensure optimal flow conditions for the Underfill.

5. The dispense pattern is typically "I" along one side or "L" pattern along two sides, focused at the corner. Application should start at the location furthest away from the chip center - this helps ensure a void free fill underneath the die. Each leg of the “L” or “I” pattern should not exceed 80 % of the length of each die edge being dispensed.

6. In some cases second or third application of product may be necessary.

7. For low viscosity one UF1230, we recommended: Purple one 21 gauge (ID 0.5, OD 0.8 mm). But based on your die size, gape height, and how long you want it to fill, you can adjust your needle size from 22 to 15 gauges.

8. Please follow the TDS for cure profile. Lower temperature with longer cure time is feasible. But customer will need to do test and trial to assure the proper lower temperature cure profile.



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