

WaferBOND® HT-10.11 AND HT-10.12 MATERIALS

Temporary Wafer Bonding Technology

Wafer-Level Packaging Business Unit

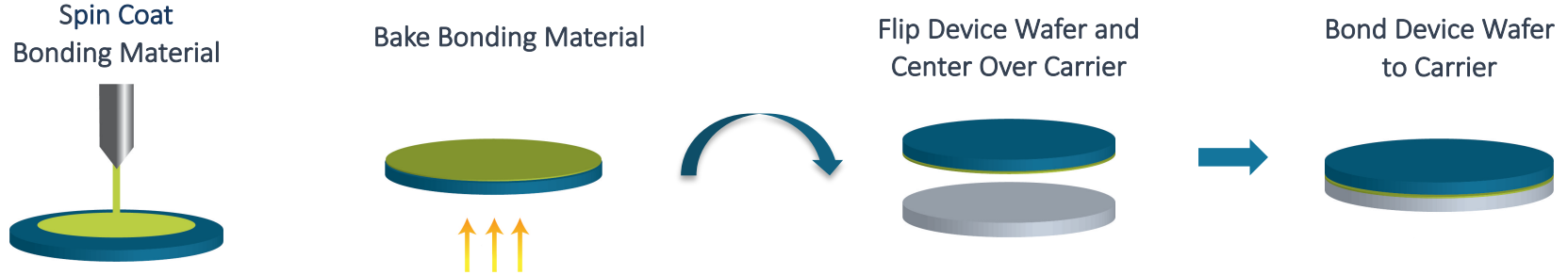
Contact info@brewerscience.com for more information

The New Standard in Thermal Slide Technology

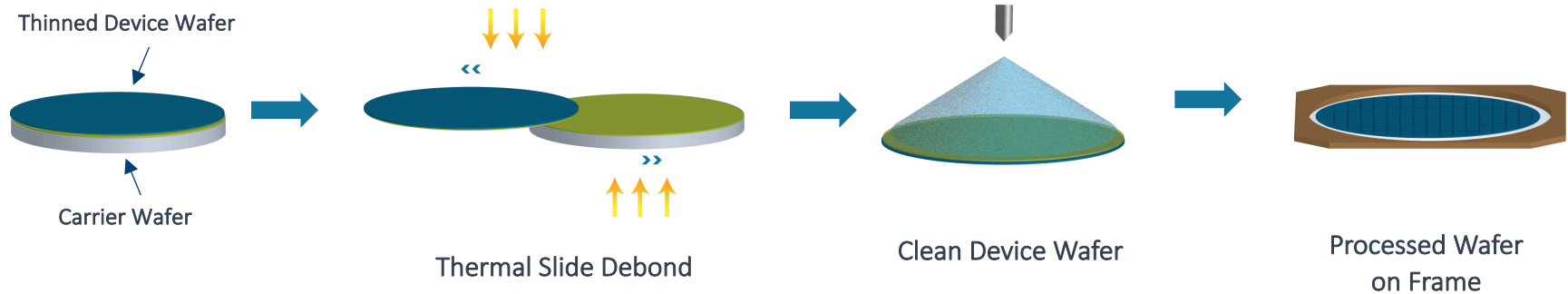
- Lower cost of ownership through increased throughput, decreased rework, wider process capabilities, and maximized device yield
- Improved via uniformity and increased die yield across substrate
- Rheology designed for maximum device support during extreme thermal backside processing
- Ability to safely handle thinned device wafers through debonding and cleaning

BrewerBOND® Thermal Slide Debonding Technology

TEMPORARY BONDING PROCESS



THERMAL SLIDE DEBONDING PROCESS



Competitive Advantages

*WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials*

Properties	Wax	WaferBOND® HT-10.11 or HT-10.12 Material
Thickness Range	~ 10 – 35 μm	20 μm – 130 μm
Coating Throughput	Requires multiple coats	Single-coat process
Bonding Temperature Range	95°C - 110°C	130°C – 180°C
Debonding Temperature Range	95°C - 110°C	150°C – 200°C
Thermal Stability Temperature Range	< 120°C	$\leq$ 250°C

- WaferBOND® HT-10.11 and HT-10.12 bonding materials are specifically designed for thermal slide processes enabling downstream thermal stability $\leq 250^\circ\text{C}$
 - WaferBOND® HT-10.11 material is also compatible with chemical release, mechanical*, and laser* debonding
- Ease of use in process, ultimate manufacturing quality, and leading-edge technical support
- State-of-the-art developmental design offering process support of device wafers through downstream processing
- Compatible with downstream vacuum process steps

*Mechanical and laser debond methods require a compatible release material

Known Application Attributes

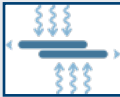
*WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials*

Focus of This Work—Thermal Slide Debond:

- Low-temperature, low-stress thermal slide debonding using GaAs, SiC, epoxy mold compound, silicon, GaN, glass, and sapphire
 - WaferBOND® HT-10.11 material at thicknesses < 75µm
 - WaferBOND® HT-10.12 material for thicknesses ≥ 75µm

WaferBOND® HT-10.11 Material Also Facilitates:

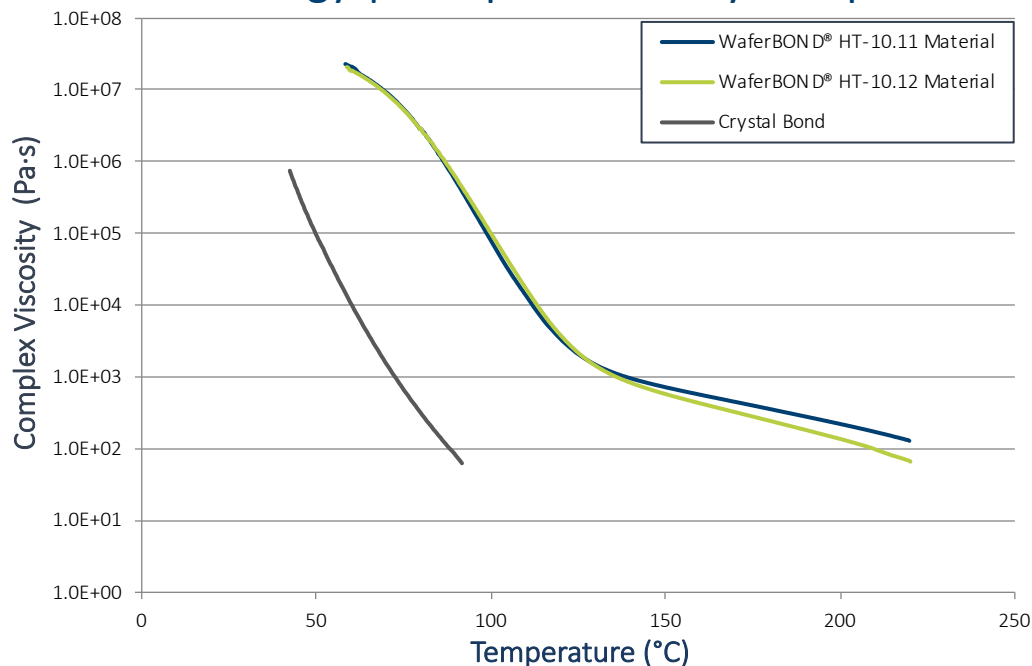
- Room temperature mechanical separation or low-stress laser debond with aid of a release layer on any of the for mentioned carriers
- Chemical separation with aid of a perforated carrier

Bonding Material & Use Range	Material Type	Mode of Release
WaferBOND® HT-10.11 (150°C- 250°C) Film thicknesses < 75 µm	High-Flow, Non-Polar Resin Blend	
WaferBOND® HT-10.12 (150°C- 250°C) Film thicknesses 75-130 µm	High-Flow, Non-Polar Resin Blend	

Material Attributes

*WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials*

Rheology | Complex Viscosity Comparison



Characterization: WaferBOND® HT-10.11 and HT-10.12 Materials

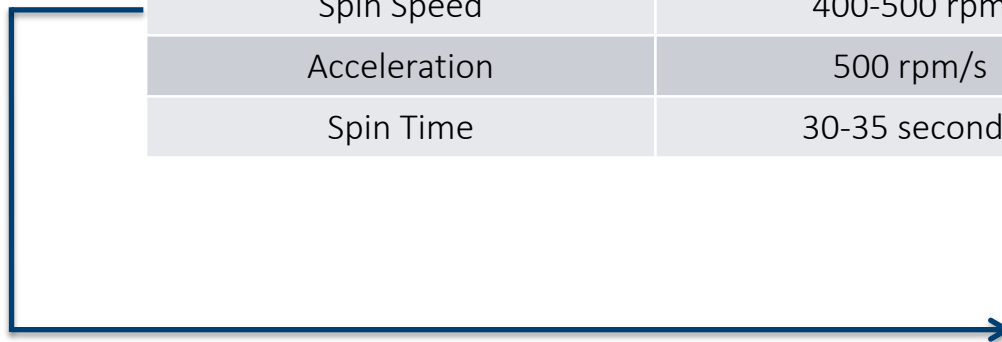
- Viscosity (Brookfield) at 25°C:
 - ~ 1615 cP for WaferBOND® HT-10.11 Material
 - ~ 4325 cP for WaferBOND® HT-10.12 Material
- T_d (TGA*) ~ 285°C (air)
 - *IPC-TM-650 2.4.24.6 (2% loss)
- T_g (DSC) ~ 50°C

Spin Speed Curves and Material Bakes

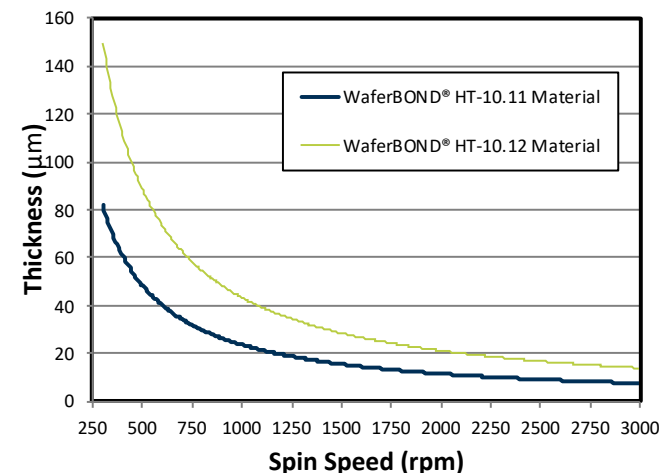
*WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials*

Spin Coating & Baking (50 µm & 100 µm Process), Material Dependent

Coating Parameters	200-mm & 300-mm
Dispense	Static on wafer center
Spin Speed	400-500 rpm
Acceleration	500 rpm/s
Spin Time	30-35 seconds



		Proximity Bakes at 0.5mm (Temp, Time)		
Material	Thickness	Bake 1	Bake 2	Bake 3
WaferBOND® HT-10.11	50µm	120°C, 5 min	180°C, 6 min	N/A
WaferBOND® HT-10.12	100µm	80°C, 5 min	180°C, 5 min	220°C, 10 min



Note: 5mm edge exclusion was used

Bond and Debond | Processing Windows

*WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials*

Bonding Process	150-mm & 200-mm	
Temperature*	160°C - 170°C	
Time	1 min	
Vacuum	≤ 5 mbar	
Force	150-mm: 1000-1200N	200-mm: 2100N

Thermal Slide Debonding Process	150-mm & 200-mm	
Temperature*	180°C - 190°C	
Force	3- 4 lbf	
Speed	2 - 3 mm/s	

Conditions may need adjustment depending on the topography and structure of the device wafers

* Can be bonded at temperatures as low as 130°C and debonded at temperatures as low as 150°C

CSAM Images after Heat Treatment

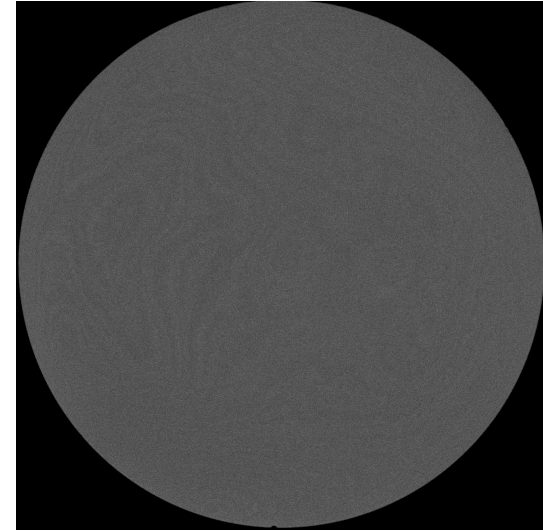
*WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials*

WaferBOND® HT-10.11 MATERIAL



- 250°C for 30 minutes at ~3 mbar pressure

WaferBOND® HT-10.12 MATERIAL



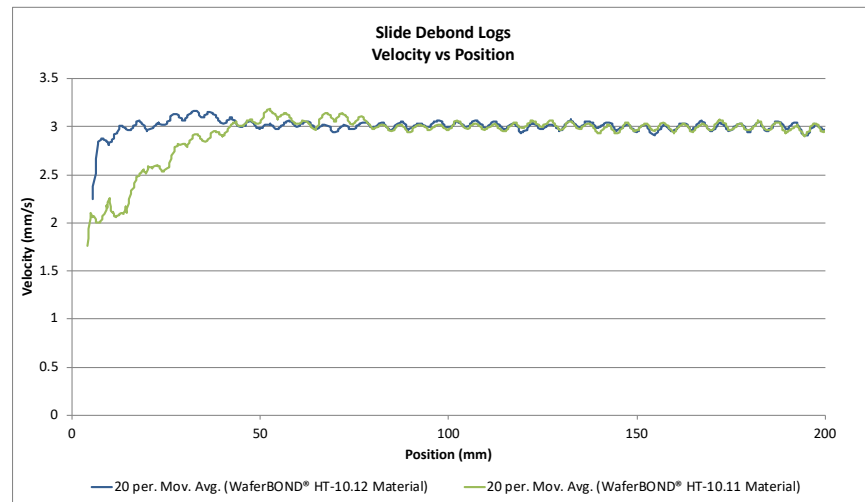
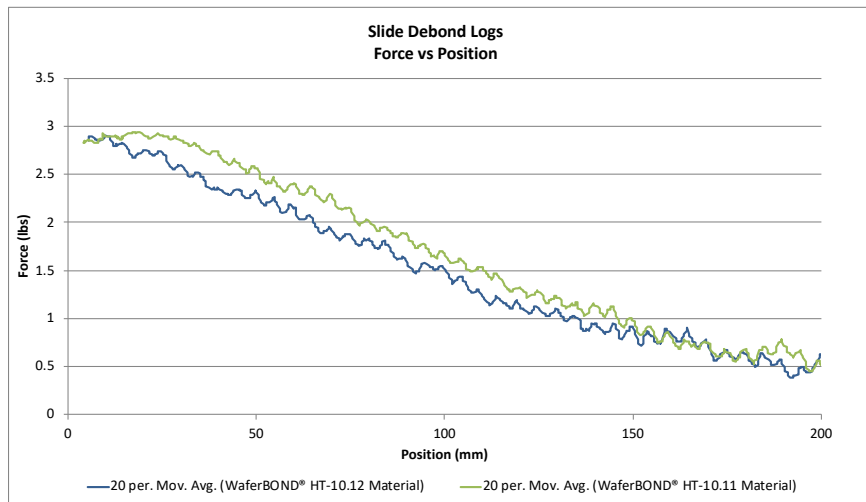
- 250°C for 30 minutes in a N₂ oven

WaferBOND® HT-10.11 and HT-10.12 materials show no signs of voiding after 250°C heat treatments

Thermal Slide Debonding | Slide Debond Logs

Comparative Slide Force and Slide Velocity

*WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials*



WaferBOND® HT-10.11 and HT-10.12 materials require similar force when using BKM conditions (190°C for WaferBOND® HT-10.12 material, 200°C for WaferBOND® HT-10.11 material). By increasing the film thickness, wafer pairs can typically be debonded with less force and less time.

Notes:

- The CEE® 1300CSX Thermal Slide Debonder utilized for this evaluation is not a QC tool and certain factors could account for slight variance in results

Thermal Slide Debonding | Time-to-Debond

WaferBOND® HT-10.11 and
WaferBOND® HT-10.12 Materials

- Average time-to-debond of wafer pairs bonded with WaferBOND® HT-10.11 and HT-10.12 materials are listed below
- Thinned wafers from the on-wafer performance testing align with full thickness test wafers

Material	Average Time-to-Debond (minutes:seconds)
WaferBOND® HT-10.11	01:15.7
WaferBOND® HT-10.12	01:10.3

WaferBOND® HT-10.11 and WaferBOND® HT-10.12 materials require similar time to slide debond when using BKM conditions. By increasing the film thickness, wafer pairs can typically be debonded with less force and less time.

Notes:

- The CEE® 1300CSX Thermal Slide Debonder utilized for this evaluation is not a QC tool and certain factors could account for slight variance in results

Summary

WaferBOND® HT-10.11 and WaferBOND® HT-10.12 Materials

- Low-stress material for high-stress device applications
- Broader thickness range in a single coat: Up to 130 µm
- Cleans faster and with less solvent than historic materials
- Broad temperature range for thermal separation: 150°C to 200°C
- Compatible with room temperature mechanical, thermal slide, laser, and wet chemical bath debonding
 - WaferBOND® HT-10.12 material is only recommended for thermal slide debond applications with film thicknesses > 75 µm; all other methods are recommended with WaferBOND® HT-10.11 material at thicknesses ≤ 75 µm
- Survives high temperature: up to 250°C!



THANK YOU!

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Benefits of Working with Brewer Science

Technology Leadership:

Dedication to provide advanced materials innovation & manufacturing

Integrated Solutions:

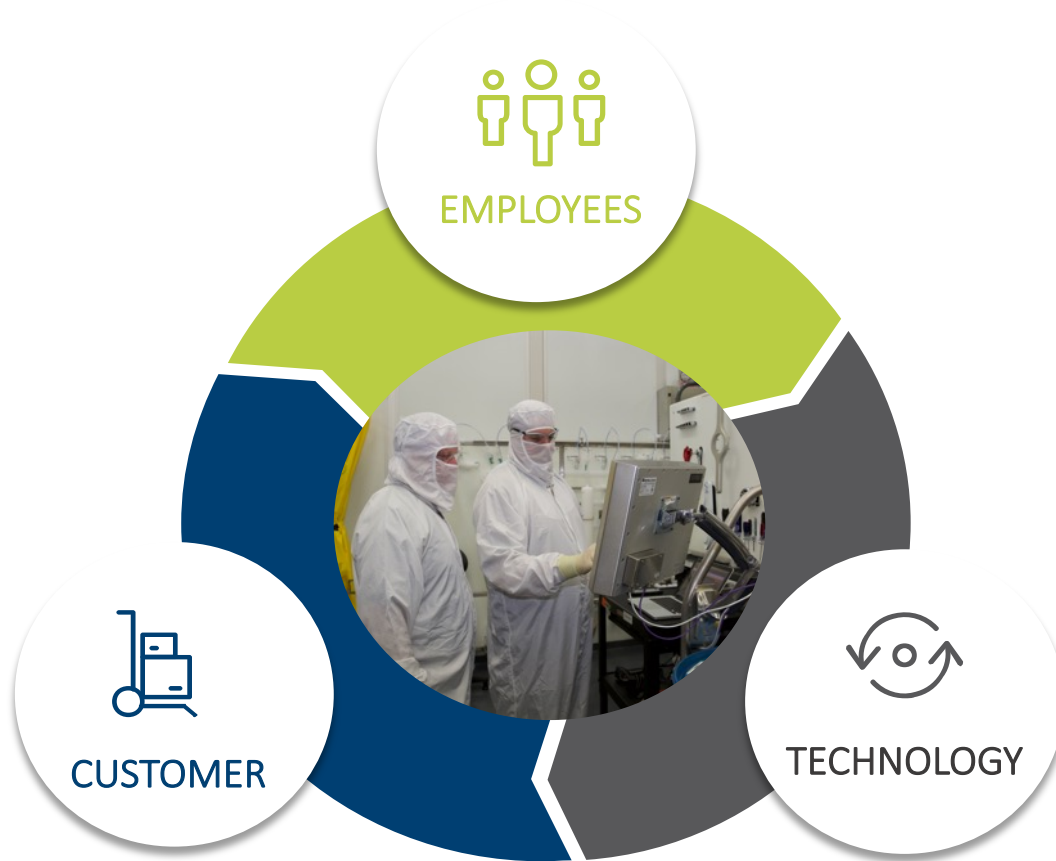
Increased performance & reduced risk for customers

Empowered Innovation:

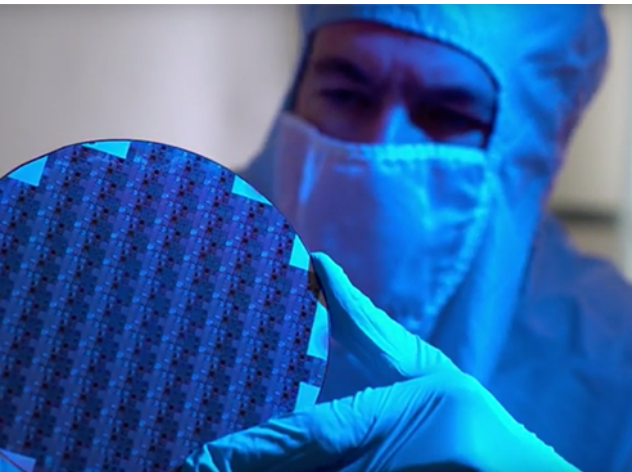
Provided through research, materials, process improvement & collaboration



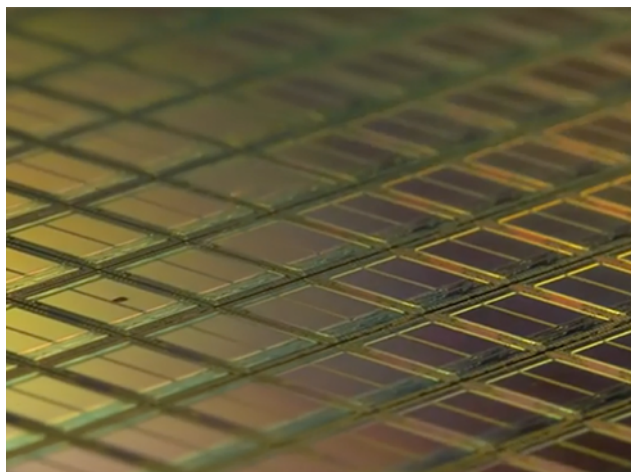
Mission & Vision of Brewer Science



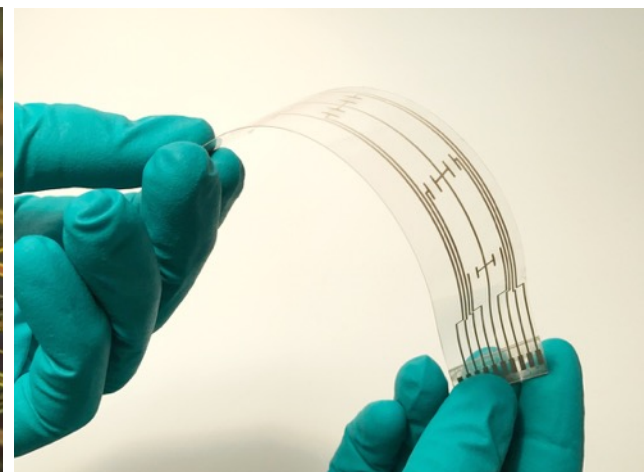
What We Do



Advanced Lithography



Wafer-Level Packaging



Printed Electronics

As a leading technology innovator and manufacturer, Brewer Science is here to help with the world's semiconductor and micro- and nanoelectronics needs.



A Global Community

North America

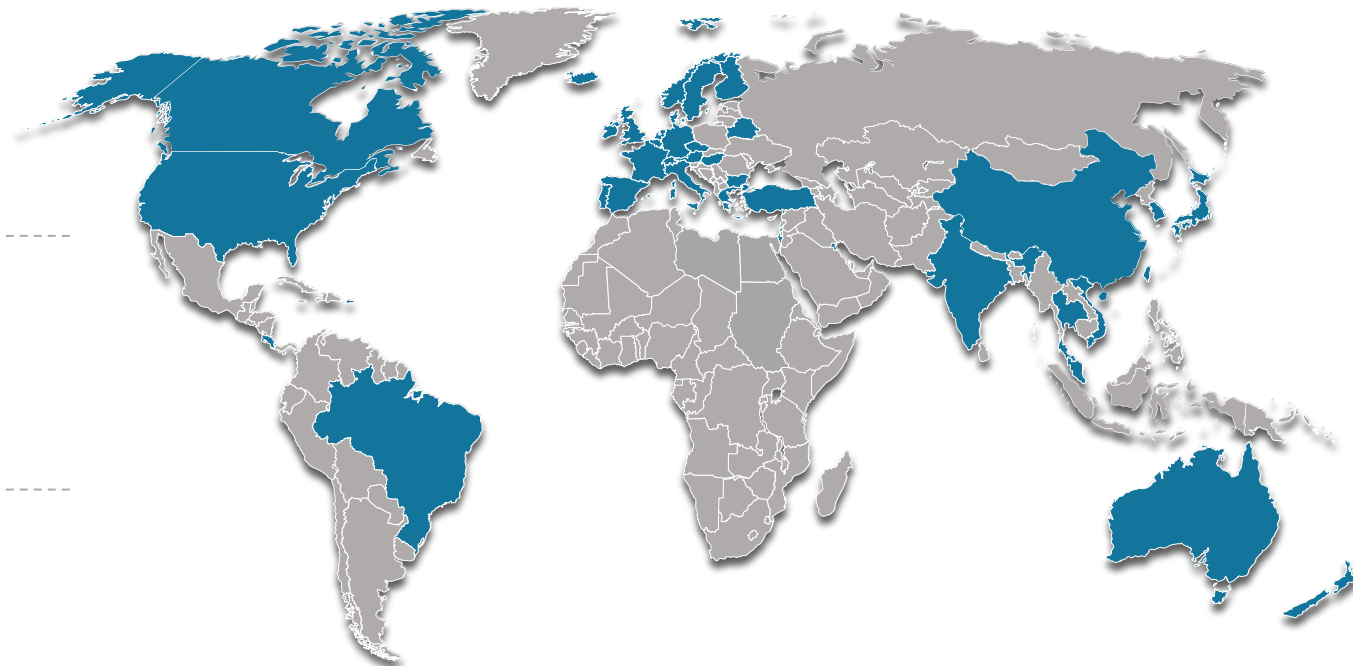
- California
- Colorado
- Massachusetts
- Missouri
- Texas
- Washington

Europe

- Derby, England
- Grenoble, France
- Leuven, Belgium
- Munich, Germany

Asia

- Central, Hong Kong
- Seoul, South Korea
- Shanghai, China
- Taipei, Taiwan
- Tokyo, Japan



*Brewer Science supplies products worldwide