Brewer Science, Inc. leading the world in thin wafer handling solutions

Dan Wallace
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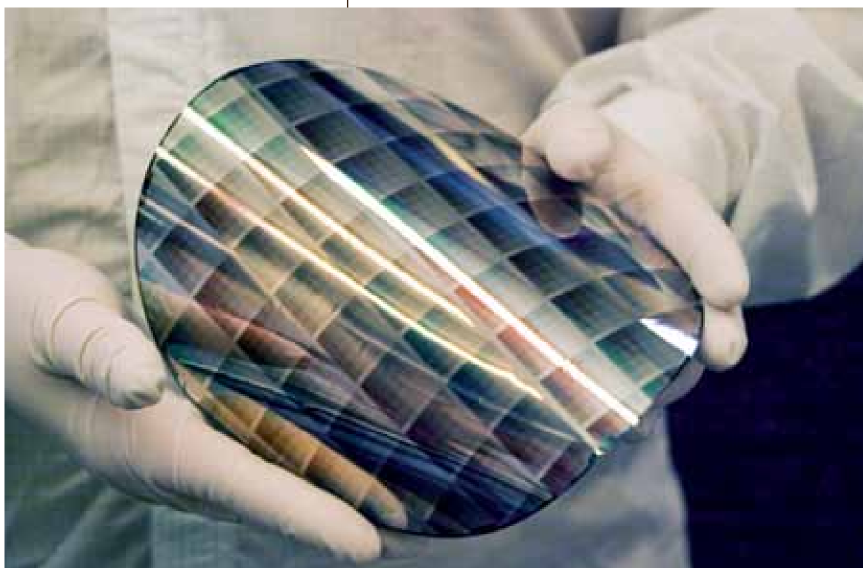
Yole Développement: Dan, you started with Brewer Science in 2008. How about a little background on what you were doing before you joined Brewer Science and what your current role there is?

Dan Wallace: I started in the industry in 1981, so I certainly have seen many advancements. Most of my career was with Motorola, and I later moved to Freescale Semiconductor when Motorola spun off their semiconductor products group. With Motorola and Freescale I was involved in a broad range of positions such as R&D, manufacturing, product management, marketing, and business management. When I left Freescale to join Brewer Science, I was the operations manager for the MEMS Pressure Sensor Business Unit.

Now in my position at Brewer Science as the Director of the Advanced Packaging Business Unit, I find that this experience has given me a unique vantage point in understanding many of the challenges our customers face.

YD: Brewer Science, Inc., is a 30-year-old company with headquarters in Rolla, Missouri. Can you give us a little background on how the company started?

DW: Brewer Science is a privately held specialty chemical company founded in 1981 by Dr. Terry Brewer and headquartered in Rolla, Missouri. Brewer Science delivers materials, processes, and equipment for applications in semiconductors, advanced packaging/3-D ICs, MEMS, displays, LEDs, and printed electronics.



Thin Wafer BSI (Courtesy of Brewer Science)

Everything about the company is unique, from the fact that it's a high-tech company located in rural Rolla, Missouri, to its 30-year history of consistent and successful global growth. Brewer Science's open-minded approach to customer needs and in-depth knowledge of process technologies has helped it to grow to be a global company with employees and offices in Asia, Europe, and North America supporting a worldwide customer base.

The company's vision and commitment is focused on introducing innovative technology solutions for the ever changing needs of the microelectronics industry.

YD: We have seen that Brewer Science recently opened new offices in Tokyo, Japan, and Seoul, Korea, to go along with offices in Taipei, Shanghai, and Hong Kong. Are these sales offices? How do you handle "field engineering" for customers? Do you have engineers stationed in Asia? Or are technical issues dealt with from the US?

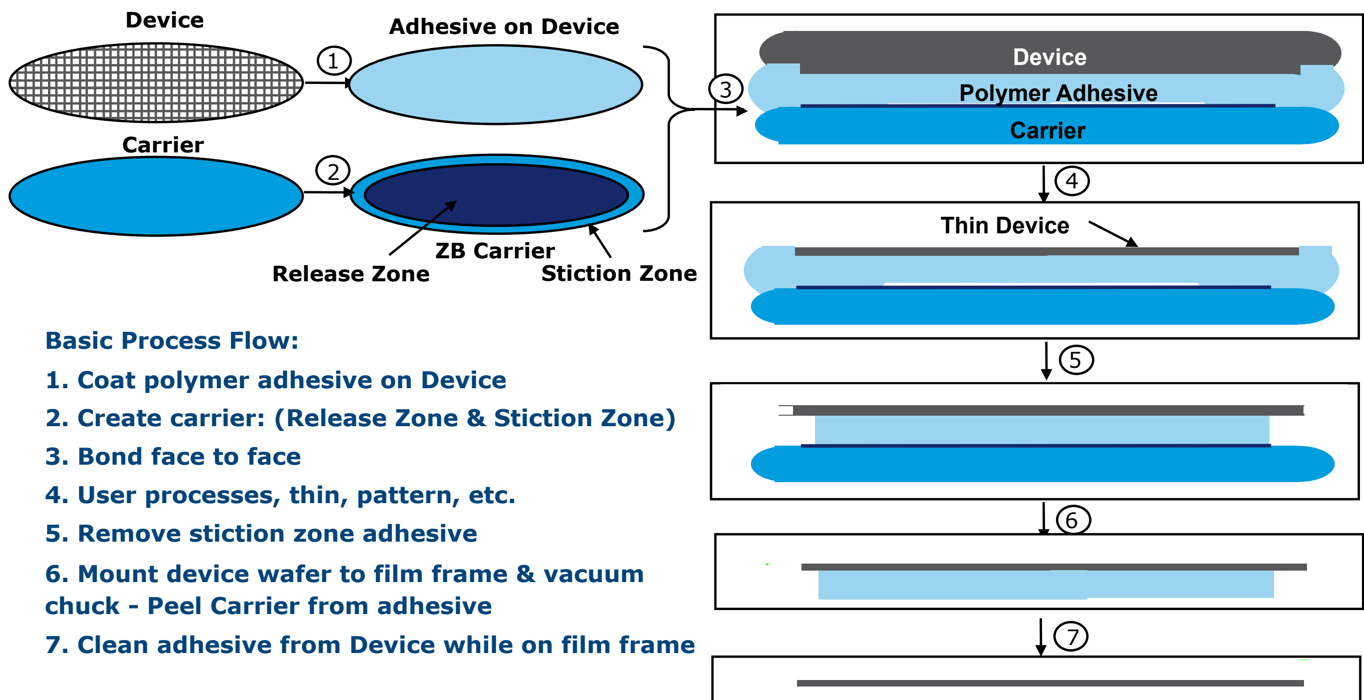
DW: Brewer Science is purposefully executing a long-term strategy of developing more local support in the regions where we continue to see growth. The type of support will depend upon the needs of that specific region, although in most cases we are installing sales and some level of field applications support with US applications always very much involved. It would be important to note that Brewer Science has made a considerable investment in Taiwan by opening up an applications lab in early 2009. Already the size of the lab has doubled, and it continues to install equipment in support of Brewer Science products. As of today, the Taiwan lab is supporting a significant portion of our applications work in Asia.

YD: A little introduction to your main product lines is probably in order. Brewer Science is probably best known for its ARC® anti-reflective coating products used in the microlithography world. Please give us a bit of a description of your main product families.

DW: After inventing anti-reflective coatings 30 years ago in 1981, Brewer Science's continuing approach is to create and deliver innovative, originally developed materials and process solutions that enable a variety of microelectronic processes and allow a competitive edge for our customers. We make a significant investment in R&D, which is apparent

Latest Solution - ZoneBOND™
Room temperature debond process

(Courtesy of Brewer Science)



given the leadership role we play in the industry. Brewer Science has commercial products and developmental activities focused in the areas of lithography, LEDs, solar applications, MEMS, carbon nanotubes, printable/flexible electronics, and advanced packaging. As far as specific products, Brewer Science continues to expand its scope with CNTRENE® microelectronics-grade carbon nanotube solutions, ProTEK® temporary etch protective coatings, WaferBOND® temporary bonding materials, ZoneBOND™ low-temperature debonding system, OptiNDEX™ high refractive index coatings, and Cee® benchtop laboratory processing equipment.

I would like to mention that Brewer Science really identifies a product in much broader terms beyond a bottle of polymer or a piece of equipment. The value that Brewer Science offers is the ability to deliver solutions to the industry based on our 30 years of experience. These solutions will include not only innovative materials but also our equipment and process experience.

YD: Certainly i-Micronews readers are all aware of the WaferBOND® temporary bonding products. It's been clear that Brewer Science was the first chemical company to understand the need for temporary adhesives. Was this the result of your membership in EMC-3D consortium in 2007 or were you aware of these needs earlier?

DW: Brewer Science was aware of the coming opportunity much earlier and started working on temporary bonding in 2003. We launched our first temporary bonding material, a WaferBOND® product, in 2006. Since that time we have introduced several improved temporary bonding materials in support of the high-temperature slide debonding process. More recently, Brewer Science has introduced our patented ZoneBOND™ technology, which was developed to solve many of the industry problems with existing thin wafer handling processes.

In addition, Brewer Science has authored over 20 publications and has been issued over 70 US and international patents related to 3D technology, which has further positioned Brewer Science as a market leader for this technology.

YD: We have heard that there are now several grades (differentiated by temperature stability and removal temperature) of WaferBOND® products available. Can you elaborate?

DW: I first should talk about our temperature ratings of materials. For lack of a better method, we have chosen to assign a value representing the temperature capability or tolerance of that adhesive. For example, we say our WaferBOND® HT10.10 product is a 220°C material. This description is very general because the overall capability of the material is dependent on not only the back-end processing temperatures but also on many other factors that influence how well the material will perform during back-end processing. These factors include time at temperature, the presence of a vacuum or pressure environment, energy level such as in a PECVD process, and the degree of wafer stress at elevated temperature. Depending on these factors we have seen WaferBOND® HT10.10 material performs well at 250°C and in other cases fails at 200°C. Our development efforts have taught us that all related process factors must be well understood.

WaferBOND® HT10.10 material is our current commercially released product. At the same time, we are also working on several new advanced platforms of adhesives targeted for temperature capabilities of up to 300°C. We have chosen to work with key customers in the development of these materials to ensure our developmental goals align well with our customers' needs.

YD: Since the 3D IC market has been "coming soon" for a few years now, how does a moderate-sized company such as Brewer Science decide on the appropriate investment level for such leading-edge technology developments? Did you get in too early? or was your timing just right?

DW: Your question is a very interesting one, and I am sure on where every company has experienced both scenarios. If we could accurately predict when a new technology such

as 3D IC may launch, we would rule the world. More often, that is not the case. It is Brewer Science's focus to invent and provide cutting-edge technology solutions, and entering the 3D IC market was a result of following this approach. Some of our methods may be more confidential in nature, but, in general, to aid in reducing the risk, we work closely with key suppliers and customers throughout the supply chain. These relationships have been instrumental in helping Brewer Science to determine the level of investment versus when a new technology may launch. Entering as early as we did has helped us in developing broader relationships in the industry and in understanding the applications much better than any of our competition. In that respect, I believe our timing was just right.

YD: Does being a mid-sized chemical company give you any advantages over the "big boys"?

DW: I find that, overall, we move faster. Communication is much easier because 90% of the company is within the same campus, so most of our colleagues are a 5-minute walk away. In addition, our processes foster close connections with our global employees. Usually decisions are made in hours rather than weeks or months. Our customers also recognized that because we are a mid-sized company we have greater flexibility in responding to their current technology needs and developing innovation that will address future challenges.

YD: Since most 3D customers clearly want an "equipment + materials" tested solution for their thin wafer handling needs, your relationship with EVG has certainly helped introduce your material solutions to the industry. How has that developed through the years?

DW: Brewer Science and EV Group early on recognized that the solution for temporary wafer bonding will not be just material or equipment alone, but it will be the combination of both working together. Given this, we have made much progress over the years advancing the development of temporary bonding technology. Now as the industry is coming closer to actually launching 3D IC technology, it is key for the market to have multiple suppliers in order to meet the demand and continue innovation. Thus Brewer Science continues to work with EV Group in the marketing of high-temperature slide debonding equipment and materials, but we are also pursuing a non-exclusive path with multiple equipment suppliers on newer technology, such as the Brewer Science ZoneBOND™ process.

YD: We've seen recently that Suss Microtec is also offering a "WaferBONDlike" solution for its bonder/debonder equipment line. Care to discuss your relationship with Suss?

DW: As mentioned above, we are pursuing a non-exclusive path with multiple equipment suppliers on technologies such as WaferBOND® and ZoneBOND™ technologies. Ultimately we see this as the best way to serve the market needs and drive further innovation in both equipment and material development.

YD: The EMC-3D consortium appears to be winding down. Care to comment on how membership in this consortium affected your overall 3D business strategy?

DW: We benefited in several ways from the relationship. Certainly the combined process evaluation work of the membership was extremely beneficial. I would also say the work put into the CoO model was a good experience. Even though some of the input data may still need to be refined, the baseline model will prove to be a useful tool for the industry.

YD: Being out there on the front line of 3D IC you certainly must have a perspective on how much longer it will be until we see real product-driven commercialization. What's your best guess?

DW: I think we all recognize from conferences and direct customer partnerships that we will see launches starting in 2012 to 2013. These may be slow at first while the main concerns are still being resolved. But as the industry begins to resolve the major concerns and the volumes help drive down the costs, I believe the benefits of 3D IC will drive a whole new market and level of performance.

YD: We saw that you created a research collaboration with CEA Leti in 2009. What was that about, is it still in place, and how has that worked out?

DW: We continue to work with Leti, with our efforts focused on evaluating developmental temporary bonding material performance through various backside processes and related process development, such as coating, bonding, debonding, cleaning, etc. I think we would all agree that the relationship has been very valuable.

YD: The latest 3D based technology we have seen from Brewer Science is the "Zonebond Process." Can you give us a short description and status report?

DW: A picture is worth a thousand words. The scheme on the previous page describes the process pretty well. The motivation in developing a process technology such as ZoneBOND™ was driven by the desire to solve several key customer concerns with the existing thin wafer handling technologies. Overwhelmingly, our goal was to develop a solution that would offer maximum protection to the thinned device wafer, enable the use of value-added materials with a higher temperature tolerance, and lower the overall CoO by increasing throughput for both bonding and debonding. Based on results to date, I am confident that we will deliver such a solution.

YD: Any other new products coming through the pipeline that our readers should be aware of?

DW: I would love to share that information with you, but until we are closer to commercialization such activities are of a confidential nature. All I can say is that we continue to invest a significant percent of revenue in developmental activity aimed at new disruptive technologies that will enhance existing processes and expand capability to address existing and new applications for the microelectronics industry.

www.brewerscience.com

Dan Wallace
Director of Advanced Packaging SBU Brewer Science Inc.
Dan has been in the electronics industry for over twenty-nine years working in diverse and progressive roles in device design, manufacturing engineering, marketing and business development. His current focus is on material and business development for advanced material and process solutions in the area of thin wafer handling for 3DIC packaging applications.

Dan's background spans a broad range of technologies including, Power MOSFET, custom Analog IC's, and MEMS products for the automotive market place. He has a masters in business, bachelors in electrical engineering and is a certified black belt in LEAN/Six-Sigma practices for manufacturing and business processes. Dan has authored several papers, patents and has spoken at various conferences.