

# The Electronics Industry Going Forward

There is no industry like electronics in market, technology, and promise. For the last three decades, the industry has led globalization. This innovative industry has made many companies and individuals prosperous. Its ability to adapt to changes in speed and quality has been utterly stunning. What will happen in the future? Can growth and innovation continue?

## Market

The electronics industry reached a \$1 trillion market in 2000, perhaps \$2 trillion in 2007, and became the largest employer. I anticipate the \$3 trillion dollar market may take an even shorter time to reach. Overall, market push, global competitiveness and the ever-shortening life cycle of electronic gadgets will continue to drive technological development, and thus help determine market growth. It is expected that the industry will remain strong, barring any cataclysmic economic downturn, vis-a-vis the 1998 Asia financial crisis.

In the electronics hardware market, globalization is a key factor. In this globalization era, the ability to move scientific discoveries from the laboratory to the manufacturing know-how to the marketplace quickly, the prowess of practical knowledge, and entrepreneurship make a formidable niche.

China's industrialization and economic reform is an integral part of globalization. Just by its sheer population, the country is of paramount importance to the global market. Thus, China, inevitably, will continue to play a dominant role, not only as a manufacturing hub (refer to my columns: 1997 July and 1999 September *SMT*) but also a consumer market. Considering the global forces — political, economic, or societal — coming from different directions, China, as a manufacturing hub and new business land, will lift the competitive bar and accelerate global market competition.

## Technology

Innovation in this industry is mandatory and will continue. As a result of market de-

mand, convergence of key applications of data, computing, voice, video, communication, and entertainment in digital and wireless format will drive technology and the end-use products.

Innovations in optoelectronics, photovoltaics, and other energy-related electronics, display technologies, embedded technologies, and nanotechnology (non-fad apps) are the main thrusts. Semiconductor materials continue to extend silicon technology to produce low-cost, high-performance products. The 450-mm wafer and 15-nm circuitry are on the horizon.

In the downstream of the hierarchy, the "well-rounded" printed circuit system that possesses controlled coefficient of thermal expansion (CTE), moisture resistance, reduced impedance, and increased dimensional and thermal stability, while still being low cost, is in demand. This system always can open a market. The materials, design, and processes that can minimize heat exposure, eschew potential heat-related damages during manufacturing and service, lower energy consumption, and enhance green environment are the most desirable and marketable features.

Overall, the introduction of various new enabling technologies are expected for 2008, albeit not in the category of disruptive technologies.

## Environment-friendly lead-free electronics

2008 will be a banner year for reliability. It would be a remiss not to say a few words on this topic. In order to achieve high-reliability lead-free assemblies, the first and foremost is to avoid high process temperature. That is to maintain the tin/lead (eutectic) processing temperature. The second most important is to have robust lead-free interconnect material, meaning an intrinsically durable solder alloy. An inferior material can not deliver a superior interconnection. As stated

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previously in this column, a ternary alloy is unable to meet these top two requirements. That means we have to resort to science-based quaternary alloys, which deliver adequate microstructural stability during the intended service life of assemblies in harsh environments. The divergence of solder alloys will resurface to meet the reliability performance needs. Further discussion will appear in my future columns.

## Business

With unstoppable globalization, rapid technological changes, and powerful tools available for doing business, the cornerstones of corporate strategy are to raise the intellectual bar, climb up the food chain, and move up the technology curve. Going forward, the competitiveness across industries will rely on the efficient use of materials, timely introduction of better products, and relentless innovation for unique or desired properties and performance. Visionary anticipation and intimate understanding of the global trends and market drivers, in conjunction with prompt and seamless execution of broad-based knowledge, are the ways to drive enterprise growth and profits. **SMT**

## APPEARANCES

Dr. Hwang will deliver a lecture on "Lead-free Reliability for Harsh Environment Electronics" in Las Vegas on March 31, 2008.



**Jennie S. Hwang, Ph.D.**, an *SMT* Advisory Board member, was elected to the National Academy of Engineering, inducted into the WIT International Hall of Fame, and named an R&D Stars-to-

Watch. Dr. Hwang serves on the board of Fortune 500 NYSE companies, government committees, as well as civic and university boards. Contact her at (216) 839-1000; JennieHwang@aol.com.