

The Role of Nanotechnology in the Semiconductor Industry

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THE nanotechnology industry is currently one of the most active and promising fields of technology. While there's been discussion of nanotech applied to everything from clothing to golf balls, the main area of research funding and investment is clearly centered in materials research applied to semiconductor technology.

One of the biggest challenges for nanotechnology today is fabrication. The cost to build a new semiconductor fab reaches easily into the billions of dollars. This has led many within the nanotechnology industry to investigate what can be done with already existing semiconductor technology. After all, advanced semiconductor processing is already taking place well below 100nm, the threshold for nanotechnology.

In addition, consumer products are becoming more feature rich, with consumers unwilling to pay substantially more for these features. The challenge to device designers is to put more features into the same or smaller devices without significantly increasing costs. In order to get more functionality, devices must shrink even further. Nanotechnology breakthroughs promise to help our industry break out of the basic physics barriers we're facing with miniaturization, along with addressing the heat problems associated with device shrinkage.

As devices shrink, pushing Moore's Law to its limits, the semiconductor industry has had to be creative with pushing the size envelope. Now, feature sizes of some devices are as small as a few atoms thick with line thicknesses of just one atom. Manufacturing

is quickly hitting a brick wall with current methods. This is one area where we're seeing significant research investment, for example, with transistors on carbon nanotubes, new crossbar architectures, and nanowires, to name only a few.

There are also many difficulties in testing at the nanoscale level. For instance, it is incredibly complex to probe down to the device level for failure analysis and other testing. This requires new testing equipment, probes, and new nanotech measurement standards, such as the IEEE standards just adopted for carbon nanotube testing. Typical semiconductor probing systems today will require major overhauls to be able to probe future generations of nanotech-driven electronic products. KEITHLEY

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