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DC Sputtering Cuts Deposition Times and Costs

KDF Inc. of Rockleigh, N.J., has developed a DC reactive sputtering process that promises to drastically reduce deposition times for dielectric films. Moreover, because it employs off-the-shelf components, it promises to offer this increased throughput at a lower cost than existing DC systems.

The sputtering systems for photonic applications tend to employ RF diode or magnetron deposition, which are reliable but time-consuming. "One of our customers manufactures mirrors that use 30 alternating layers," said Subhadra Gupta, the company's director of technology, who helped develop the process. "It takes close to 24 hours to do this with the standard technique."

The process employs off-the-shelf components and promises five to 10 times the throughput.

In contrast, the new technique can deposit silicon dioxide at up to 650 Å per minute, reducing the time to deposit 1 µm of the material from five hours to 15 minutes. "We can easily get five to 10 times the throughput from reduction of the process time," she said. "The overhead times remain the same."

The technique employs a magnetron cathode that is standard to RF processes. A static array typically cannot be used with DC sputtering because the dielectric material accumulates on parts that are not sputtered, Gupta said. The plasma tends to de-ignite, and the process suffers arcing and plasma instability.

The company's researchers thus incorporated a Pinnacle Plus switching power supply from Advanced Energy Industries Inc. that features arc suppression. The ability to control the accumulation of charge allowed them to dispense with the complex and expensive components, such as advanced sweeping cathodes, that DC reactive sputtering traditionally requires.

In a demonstration, KDF simultaneously sputtered a boron-doped silicon target and a quartz target using the DC and RF processes, respectively. In the metallic-rate mode, the DC system produced high-quality silicon dioxide films at 633 Å per minute; the reacted-rate mode (that is, once the target is substantially reacted) was 200 Å per minute. The deposition rate of RF sputtering was only 72 Å per minute.

The technique is ready for market, Gupta said, and is being installed in a customer's tool for the fabrication of organic LED displays. The company expects to ship the system by the end of the year. □

Daniel S. Burgess

Using standard components and a switching power supply, a New Jersey company has developed a DC reactive sputtering technique that promises to greatly reduce the time required to deposit dielectric films. The KDF 744 system will target the organic LED market.

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