Bright future for new manufacturing technique

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By controlling materials at the nanoscale, Oak Ridge National Laboratory researchers believe they can greatly improve manufacturing processes of products ranging from solar cells to computers to flat-panel displays.

At the center of the optimism is a 750-kilowatt radiant plasma arc lamp that boasts 3,000 times higher heating rates and three times higher processing temperatures than those possible with conventional technologies. The Mattson Technology lamp, designed and developed by Mattson Technology and housed at the Department of Energy's ORNL, can heat a surface at a rate of 1 million degrees Fahrenheit per second.

"More importantly, the lamp achieves those laser power densities over large areas, and that enables us to produce uniform microstructures with uniform properties," said Craig Blue of ORNL's Metals and Ceramics Division.

Those capabilities coupled with ORNL proprietary "pulse thermal processing" technology already have led to significant advances in fusing wear-resistant coatings to aluminum and in several other manufacturing applications. Now, Blue and colleagues plan to add another component to the mix: flexible electronics, which encompass such devices as flexible solar cells and thin-film transistors for flexible flat-panel displays.

The pulse thermal processing method has potential applications in thin-

film transistors and magnet media, but especially in photovoltaics aimed at developing more efficient solar cells, which convert radiant energy from the sun into usable energy.

"In the U.S., photovoltaics is a $500 million industry, and the industry is growing at a rate of 30 to 40 percent per year," said Ron Ott, Blue's colleague in the project. "By 2020, the photovoltaic industry is projected to boast revenues of $15 billion worldwide."

Ott said the U.S. can share in that growth and help the nation meet its energy needs, and ORNL can play a significant role in lowering the cost of manufacturing high-performance solar cells.

ORNL's low-cost enabling technology allows manufacturers to process materials on inexpensive low-temperature substrates such as plastics. The plasma arc lamp can process areas up to 1,000 square centimeters and is capable of 1 millisecond pulses of 12 megawatts. The combination of control and power is unprecedented and opens a world of possibilities for the manufacture of advanced materials that have real-world significance.

Source: Oak Ridge National Laboratory