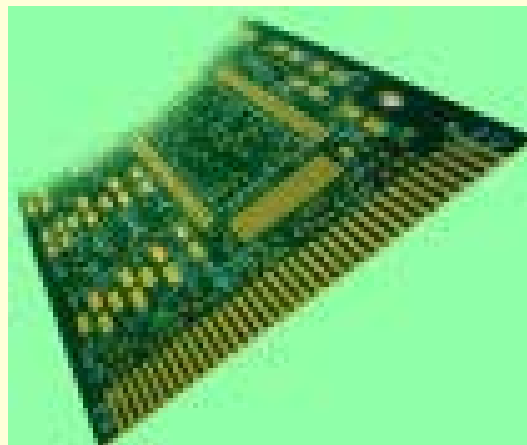


Ink Jet Technology

NREL's Ink Jet Printing for electronic circuits utilizes novel ink based technology to produce Silver (Ag) and Copper (Cu) metallizations producing results superior to screen printing; similar to those produced by vacuum based technologies. Using the ink jet technology NREL has printed Ag grids on solar cells and on glass for displays, Cu grids on glass, circuit boards, and metal. Other materials printed include transparent Conducting Oxides such as ITO, SnO, ZnO, In-Zn-O combinatorial libraries, BaSrTiO₃ dielectric constant oxides, and ferroelectric capacitors. The inks can be printed directly by ink jet technology, eliminating photolithography and screens and producing relatively high resolution lines (potentially on the scale of 10 micron lines) at a high deposition rate, atmospheric conditions, and at low temperatures. In addition, the inks can be printed on very thin substrates and curved surfaces.



The ink jet technology has many applications and can be used in the production of solar cells, flat panel displays, touch screens, printed circuit boards, flexible circuit boards, thin films, plastic films, organic semiconductors, and organic LEDs (OLEDs).

The markets that the ink jet technology can penetrate are billion dollar markets. The OLED market for small screen applications is projected to grow from \$215million in 2003 to \$3.13billion in 2007. New markets for OLEDs such as smart packaging, cell phones, flat panel displays, RFID tags for tracking, organic solar cells, luggage tags, and intelligent clothing are being rapidly developed. OLEDs are expected to penetrate the LCD PC and laptop screen market by 2008, a \$40billion market.

In 2003 750MW of solar cells were manufactured, up 50% over 2002. The solar cell market has been growing at an average annual rate of 35%. The trend for solar cells is to make them thinner, thin film solar cells are currently being marketed. Ink jet technology can print the metal contacts on the thin films without contacting them reducing breakage and is faster and cheaper than current vacuum deposition techniques. It is estimated that the solar cell market for the ink jet technology by 2008 would be \$160Million.

The value proposition the NREL ink jet technology has over current technologies (screen printing, vacuum deposition) are as follows: lower capital investment, lower processing costs, multiple applications, multiple ink substrates, and rapid prototyping.

Licensing Our Technology

NREL is looking for a strategic alliance to develop and commercialize this technology. The alliance could be a license, a Cooperative Research and Development Agreement (CRADA), or a Work For Others (WFO) that leverages NREL's unique capabilities, facilities, and personnel.

Contact Information

If you would like to explore collaborative opportunities with the National Renewable Energy Laboratory please contact Richard Bolin, 303-275-3028 or by email at Richard_bolin@nrel.gov.

Also for more technology transfer opportunities visit our Web site at www.nrel.gov/technologytransfer.

