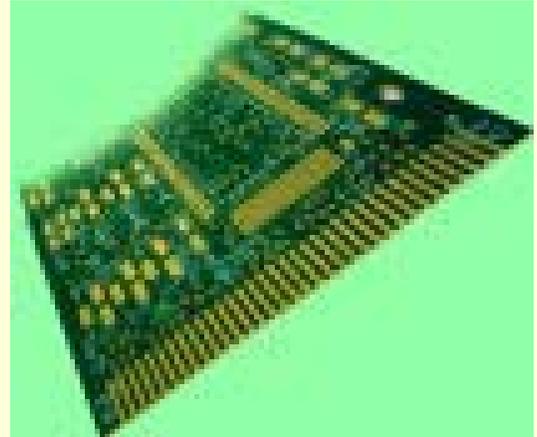


## Ink Jet Technology

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, BaSrTiO<sub>3</sub> 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 quite large. The OLED market for small screen applications is projected to grow from \$215 million to \$3.13 billion. 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 also expected to penetrate the LCD PC and laptop screen market valued at \$40 billion.

This innovative technology reduces breakage and is faster and cheaper than current techniques. It is estimated that the solar cell market for the ink jet technology would be \$160 million. 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](mailto:richard_bolin@nrel.gov).

Also for more technology transfer opportunities visit our Web site at [www.nrel.gov/technologytransfer](http://www.nrel.gov/technologytransfer).

