Cork Tech TalkNews

Manufacturers of Waterbase, UV+EB Curable Coatings, Varnishes and Adhesives

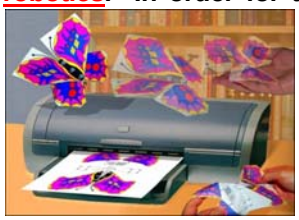
12/06

INKJET, WHEREVER IS IT GOING NEXT?

Those of us who try to keep up with advancing technologies have to continue to marvel at what most consider to be a humble, simple technology that they observe as their inkjet printers spew out print & graphics.

Unknown to most, inkjet technology is advancing (exploding) on many fronts, as the process is being explored for its potential to print a variety of developing new raw materials. These new raw materials are conceptualized as the basis for an array of mind bending new products.

Main among these is various forms of robotics. In order for these developments to proceed, a necessity will be raw materials that can be used to develop conducting circuits. Some of these are already here in the form of electrically conductive polymers. Many patents have already been granted in this area. So called synthetic metals such as polyaniline and polypyrrole are doped to perform with high electrical conductivity and have semi-conductor capability. These materials will lead to the development of light emitting diodes (LED's), field effect transistors (FET's), photovoltaic cells, conductive coatings, inks and formable polymers.



Whimsical origami robot butterfly ©2006 Jet Flyer, LLC

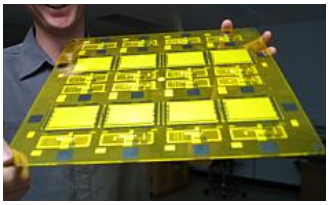
The exciting thing is that inkjet is viewed as the print process that will be developed to form and integrate electronic, mechanical and structural components using organic semi-conductors (Flextronics). Organic semi-conductors are viewed as being potentially in-expensive, easy to manufacture, and easy to process to cover large areas. Reliable, printed, flexible substrates will make possible all sorts of sensors, and interactive consumer products including appliances, furniture, toys, smart packaging, etc. Simply put, transistors will be printable, organic, flexible and cheap.

Flextronics products will be assembled utilizing inkjet technology. Depositing selective raw materials layer by layer will allow sophisticated integrated electro-mechanical devices to be built. The raw materials will include flow able energy curing (UV-EB) polymers, oligomers and nano-suspensions. Already available in these forms are products that offer conductivity, structural support, and electro-mechanical sensing and actuation.

Newly commercialized are printable polymer film inkjet inks; silver-based, carbon-based and graphite-based inks, that allow the fabrication of conductor and resistor circuit components. Inkjet printers are printing batteries, organic light emitting diode (OLED) display screens, RFID chips and electro-actuated polymer artificial muscles.

Present inkjet printed dry cell batteries using zinc as the anode and manganese dioxide as the cathode (applied as ink) are fabricated to generate 1.5 volts. Printed on a paper substrate they are flexible and can be specially designed for the shape and size optimum for each application. The batteries have a shelf life of 3 years and they are non-toxic and non-flammable.

Display screens of glass or plastic are being demonstrated. They are made using inkjet printed, light emitting, polymers.



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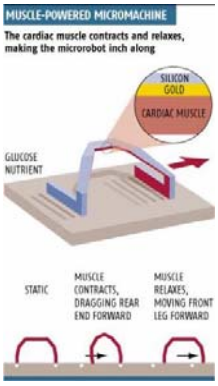
The polymer OLED (PLED) displays that result are forecast to be cheaper than current LCD screens.

RFID (radio frequency identification tags) as we know are being rapidly deployed, however prices need to be lowered. A means of accomplishing this is thought to be the adoption of printable organic (carbon based) polymers (plastics) as an inexpensive replacement for expensive non-printable silicon-based RFID tag materials. Printable chips, battery and antenna hold the promise of achieving the necessary lower cost targets.



Printable muscles, what next? Presently there have been developed many polymer based types of materials for artificial muscles. EAP's, electro-actuated polymers are one group. Another grouping is ionic EAP's which include carbon nanotubes, conductive polymers, gels, and polymer-metal composites, which are activated by the diffusion of ions across an electrolyte located between two electrodes.

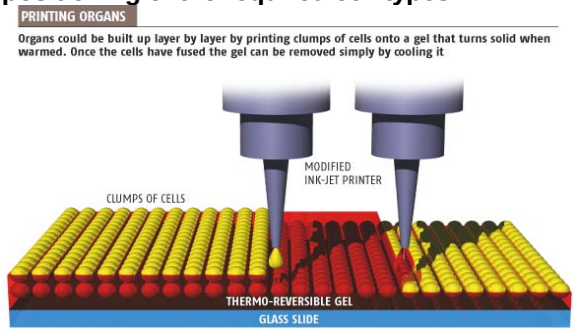
A current application has EAP's in a medical application for guiding and positioning angioplasty devices inside blood vessels. Another application, in photography, has EAP actuators powering auto focus and zoom features in small cameras.

Major advantages of EAP materials are that they are typically resistant to fracturing, are lightweight, pliable, and inexpensive and can be shaped almost without limits. Further, their properties can be manipulated broadly.

Developers and researchers of these inkjet printable technologies are visualizing an infinite arena of possibilities for the future.

One of these enticing probabilities is the development of more powerful robotic devices using more advanced EAP materials.

Inkjet technology is advancing on many fronts. Another is the research into bio-inks that are aimed at producing skin tissue for burn grafting. This approach of producing living tissue is conceptualized as a basis for producing very complex tissues and even entire organs. In this regard, 3-D tubes of living tissue have been inkjet printed using suspensions of cells as ink. Looking ahead, the printing of bio-materials offers the promise of building up tissues, layer by layer, in a precise, complex manor, by the exact positioning of the required cell types.



Illustrations courtesy of New Scientist

Another bio-material development effort is seeking to design effective polymeric drug delivery systems utilizing inkjet printing. One approach will print composite films that will be capable of continuous, controlled release of medication. More complicated, micro and nano fabrication is being explored as a means to devices that will feature biosensors for controlled, exacting drug delivery.

In contrast, other novel, yet simple applications of inkjet technology are around. For example, one exclusive oriental restaurant is printing flavored solutions, bitter, salty, sour, and sweet on edible paper. Another company is custom printing graphics, using sugars to produce edible cake decoration.

So what is the preverbal bottom line? I guess it has to be to look for inkjet to be a continuing important, printing process not only of the present, but most certainly of the future. We will see inkjet technology applied in an unimaginable array of new applications bringing us futuristic products that will stretch well beyond our imaginations.

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