Sensor of plastic can be produced in a printing press

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Electrochemical transistors made of plastic open myriad possibilities. Since both electrons and ions are active, they can function as a bridge between traditional electronics and biological systems. A new dissertation from Linköping University in Sweden describes a simple and inexpensive humidity sensor that can be manufactured in a printing press.

Electrically conducting plastic is used today in field effect transistors, light-emitting diodes, electrochemical components, and batteries. Organic semiconductors are better than silicon because they can be applied to soft surfaces, even paper, using printing technology. What's more, the components can be recycled in the same way as regular paper and plastic.

In an electrochemical transistor, both electrons and ions serve as charge bearers. It can be used in sensors, analytical tools, logical circuits, and smart displays. The current is controlled by a reduction/oxidation process, which means that it uses low-voltage current, roughly one volt, and is not dependent on small dimensions. Moreover, it has a memory function.

This dissertation by David Nilsson, from the Department of Science and Technology, describes an electrochemical humidity sensor, produced using purely organic materials. Depending on the humidity of the air, the conducting capacity of the electrolyte changes, as does the response from the transistor. The same concept can be used to gauge acidity (pH)

or the content of ions and glucose.

The vision is for the sensor, the battery, and the display to be pressed simultaneously on paper or other flexible surfaces. In that way it would be possible to produce cheap electronic “litmus paper” or reaction strips for blood and glucose testing.

Intelligent image units (pixels) are another interesting application of electrochemical transistors. Varying the current alters the color of the display and thereby the content of the image or text. The technology can be used to develop smart labels and advertising signs.

David Nilsson is a member of Professor Magnus Berggren’s research team in organic electronics. In collaboration with the electronics research institute Acreo, the team has developed printing technology for electronics on paper. Recently the Swedish Research Council provided funding for another printing press under the project Electronic Paper Printing House.