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Electrospun Fiber Webs for Thermochromic Display Applications

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Extended Abstract

The increased growth in demand for electronic devices has led to an accelerated development of display systems, which are essential components of most devices (Liu et al., 2007; Siegel et al., 2009). Moreover, the implementation of new technologies, as well as the use of flexible and low cost materials as substrates for high performance electronic devices has attracted much attention in recent years (Celle et al., 2012; Wu et al., 2010). In addition, electrospinning, or electrostatic field-assisted fiber deposition, is a simple technique used for the synthesis of fibers with a wide variety of compositions and sizes (Greiner and Wendorff, 2007); by applying a high voltage on the precursor solution, continuous and smooth fibers are drawn and collected on suitable electrodes.

In this paper, we report on the fabrication of thermally activated displays using electrospun fiber webs and flexible substrates. First, a polymer fiber mesh was obtained by electrospinning a poly(methyl methacrylate) solution on a frame collector. The average diameter value of the resulting fibers was around 600 nm. By varying the deposition time, the optical transparency of the web can be tuned, as well as its conductive properties. Further, the mesh was covered with a layer of gold or silver with approximately 200 nm thickness. The metalized web was thermally transferred on two types of flexible substrates (textile and paper) and predefined configurations of thermochromic ink were applied on the surface of the fibers. A thermochromic ink is a material which changes its optical properties in a reversible and repeatable manner by varying the temperature. If an electric current passes through the metallic layer that covers the polymer fibers, the device is subjected to resistive heating and the thermochromic ink changes its colour from red to white, making the painted shapes disappear; on cooling, the reverse transition occurs. In this way, the functionality of the final device is proved. The two described processes are similar to the activation and deactivation of a pixel. Moreover, all devices show consistency and stability over time when applying several heating/cooling cycles. It was also demonstrated that the substrate has a strong influence on the thermal behaviour of the thermochromic devices.

In conclusion, flexible and stable thermochromic devices with reproducible characteristics were fabricated by using inexpensive materials and simple techniques.

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