Development of a novel inkjet printing nanoito ink for touch screen applications.

M. Aresti[a], I.Maiza[a], A.Odriozola[a], Mª.C. Arzamendi[b], L.Gandía[b]

[a]**Cemitec, Pol. Mocholi, Plaza Cein 4, 31110 Noain, Spain**
maresti@cemitec.com, imaiza@cemtiec.com, aodriozola@cemitec.com
[b]**Universidad Pública de Navarra, Departamento Química Aplicada, 31006 Pamplona**

Abstract

Printing techniques, such as inkjet technology or screen printing, have been industrialized and become an essential part of various microelectronic devices. In last years, printed electronics has emerged as a candidate for the carrying out of low cost and large area electronic systems [1]. The inkjet technology has become very attractive for the printed electronic market, but its weak spot is the lack of inks for electronic applications. This is a small market niche, however there are more and more companies working in this area. Transparent conducting oxide (TCO) is one of the most important materials to manufacture different optoelectronic devices, such as liquid crystals, solar cells and touch panels. Among these TCO materials, Indium Tin Oxide (ITO) is the most used because of its optical transparency and electrical properties [2]. In this work, a novel nanoito ink has been developed for inkjet technology (Fig.1.). A 18 wt.% of ITO ink has been formulated. In order to obtain this ink, ITO nanoparticles with 40 nm of diameter into a mixed of alcohol solvents with dispersants and binders have been dispersed for 700 minutes in a ball mill process. Since the zeta potential of ITO powder is small (usually less than 15 mV), polymer based additives have been supplied to the solution (Fig.2.).

Viscosity and surface tension have been measured. The viscosity of the ink was 10-13 cp and the surface tension was 30-33 dynas/cm. The ink was stable in time (about 3 months). ITO film pattern has been printed using a piezoelectric Dimatix Galaxy inkjet printing head onto a flexible substrate (Kapton, from DuPont). ITO film was heated at a temperature of 250ºC for 30 minutes and, in order to improve electrical properties of the ITO film, a post-treatment heating at 300ºC was applied (Fig.3.). The sheet resistance was measured by means of a four point probe technique using two NanoVolt / Micro OhmMeter (Agilent 34411A and 34420A). The sheet resistance decreased with the second annealing, achieving 200 Ω/sq. Also, the transmittance of the ITO film was measured using a UV-Mini 1240 Spectrophotometer (Shimadzu). The ITO film showed a high transmittance, more than 85% at 580 nm.

A resistive touch panel using inkjet printing onto a flexible substrate has been prepared due to the excellent properties of the ITO film. Figure 4 and 5 show the schematic structure of the touch panel. After printing the ITO rectangles, Ag electrodes have been patterned by inkjet printing. Finally, a commercial insulator layer has been patterned onto one of the ITO layer as a separating layer. The final device showed a resistance less than 1.5 kV (Fig.6.).

References

[1] Young-Sang Cho, Hyang-Mi Kim, Jeong-Jin Hong, Gi-Ra Yi Sung Hoon Jang, Seung-Man Yang. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 336 (2009) 88-98.

[2] Ilja Maksimenko, Michael Gross, Tobias Köninger, Helmut Münstedt, Peter J. Wellmann. Thin Solid Films 518 (2010)2910-2915.

Figures

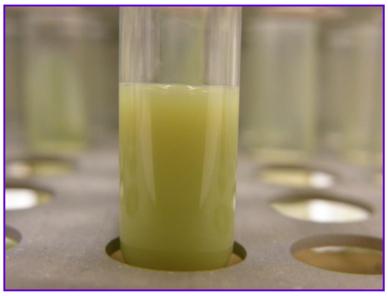

Fig.1. Formulated Ink

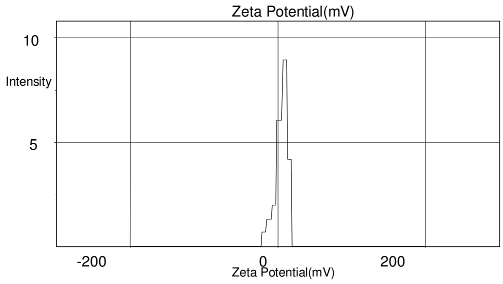

Fig.2. Zeta potential of ITO nanoparticles

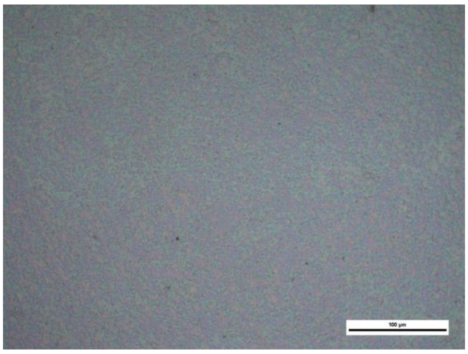

Fig.3. ITO thin film formed by inkjet printing

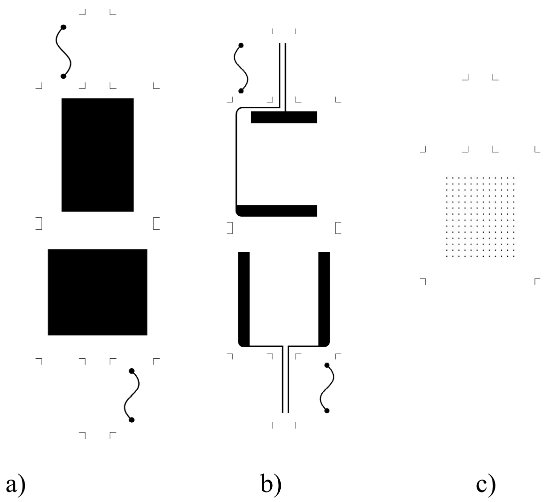

Fig.4.a) ITO pattern , b)Ag electrodes and c)insulating layer

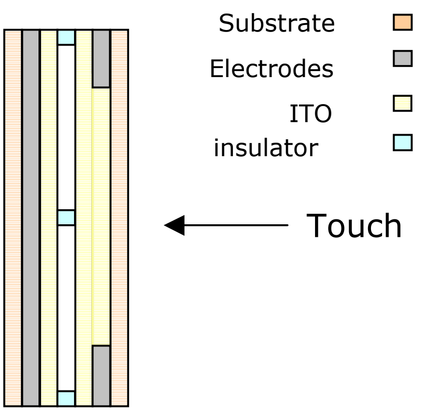

Fig.5. Schematic of the touch screen

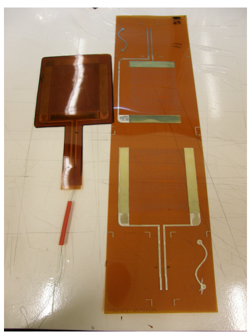

Fig.6. Printing touch screen onto flexible substrate