World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:9, No:04, 2015

Electromechanical Reliability of ITO/Ag/ITO Multilayer Coated Pet Substrate for Optoelectronic Application

Authors : D. W. Mohammed, J. Bowen, S. N. Kukureka

Abstract : Successful design and fabrication of flexible devices for electrode components requires a low sheet resistance, high optical transmittance, high mechanical reliability. Indium tin oxide (ITO) film is currently the predominant transparent conductive oxide (TCO) film in potential applications such as flexible organic light- emitting diodes, flat-panel displays, solar cells, and thin film transistors (TFTs). However ITO films are too brittle and their resistivity is rather high in some cases compared with ITO/Ag/ ITO, and they cannot completely meet flexible optoelectronic device requirements. Therefore, in this work the mechanical properties of ITO /Ag/ITO multilayer film that deposited on Polyethylene terephthalate (PET) compared with the single layered ITO sample were investigated using bending fatigue, twisting fatigue and thermal cycling experiments. The electrical resistance was monitored during the application of mechanical and thermal loads to see the pattern of relationship between the load and the electrical continuity as a consequent of failure. Scanning electron microscopy and atomic force microscopy were used to provide surface characterization of the mechanically-tested samples. The effective embedment of the Ag layer between upper and lower ITO films led to metallic conductivity and superior flexibility to the single ITO electrode, due to the high failure strain of the ductile Ag layer. These results indicate that flexible ITO/Ag/ITO multilayer electrodes are a promising candidate for use as transparent conductor in flexible displays. They provided significantly reduced sheet resistance compared to ITO, and improved bending and twisting properties both as a function of radius, angle and thermal cycling.

Keywords : ITO/Ag/ITO multilayer, failure strain, mechanical properties, PET
Conference Title : ICAMST 2015 : International Conference on Advanced Materials Science and Technology
Conference Location : Venice, Italy
Conference Dates : April 13-14, 2015