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Cryogenic ion implantation of polyethylene terephthalate (PET) thin films: structural and electrical properties

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Organic polymer based electronics have attracted attention in the semiconductor industry for many different applications which include solar cells, lighting, display, and so on. Since polymers are naturally insulating materials, enhancing their electrical properties through modification of their conductance using ion implantation is a focal research area in the semiconductor industry. Previous research shows that structural, optical and electrical properties of Polyethylene Terephthalate (PET) can be modified through ion implantation. However, most of the PET implantations reported in the literature are under room temperature conditions; not much has been done to investigate the effects of temperature on the target material during implantation. In this study, ITO coated PET is implanted with 80keV metal (Ti+) and non-metal (Ar+) ions at three different ion fluences (5 x 10^14, 5 x 10^15 and 5 x 10^16 ions/cm^2), at both room and cryogenic (liquid nitrogen) temperatures. Implanted samples are characterized using the Elastic Recoil Detection Analysis (ERDA) technique to determine the depth profiles of implanted species. Additionally, SEM, FTIR and UV-Vis are carried out to determine the morphology, chemical and molecular structure, and the electronic band gap respectively. The electrical properties of the implanted PET are investigated through current-voltage (I-V) and capacitance-voltage (C-V) measurements. This presentation describes and explains results of the characterization measurements with a view to establishing structure-property relationships of the cryogenically implanted PET.

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