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Effect of Supersonic Spraying Impact Velocity on Opto-electric Properties of Transparent Conducting Flexible Films Consisting of Silver Nanowire, ITO, and Polyimide Multilayers

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Abstract:

We demonstrate the use of supersonic spraying for the deposition of silver nanowires (AgNWs) on a flexible polyimide (PI) substrate for the formation of transparent and conducting films (TCF) as an alternative to nonflexible ITO (indium tin oxide). The self-fused intersections of the NWs resulted in films with a low sheet resistance ($R_s = 31 \Omega/\text{sq}$) and fairly high transmittance ($Tr = 92\%$) on a glass substrate. The effect of the impact speed of the supersonically sprayed AgNWs on the opto-electric properties of the flexible TCF was evaluated by varying the spray coating conditions. The fabricated films were characterized by X-ray diffraction analysis, atomic force microscopy, ultraviolet-visible spectroscopy, and scanning electron microscopy. Finally, cyclic bending tests were performed on the PI/AgNW films as well as PI/ZnO/indium tin oxide/AgNW films, and the changes in their electrical properties with bending were compared.

Keywords: Supersonic spray; Self-fusion; Silver nanowires, Transparent conducting film; Flexible substrate

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