An Efficient Computational Model for Metal Nanowire Transparent Conductors

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Transparent conductors are a class of materials widely needed for technologies such as smart phones and solar panels. The current industry standard, Indium Tin Oxide, is expensive, brittle, and in short supply. In this research, an alternative transparent conductor based on random metal nanowire networks was investigated. The specific objective of this work was to develop a versatile and efficient computational model capable of calculating the conductivity of such networks. Because the properties of this type of network depend on many independent parameters, such a model is a valuable tool for researchers looking to optimize conductivity. This computational model was validated through comparison with published experimental data. A power law relation between normalized conductivity and normalized wire concentration was determined, with an exponent of 1.73. Furthermore, the computational model was used to identify a novel method through which conductivity of the networks can be optimized: nanowire orientation. It was found that with an appropriate orientation distribution, a significant increase in conductivity can be achieved. Such advances will enable wider adoption of metal nanowire transparent conductors in industry.

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