ABSTRACT

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Title: MECHANICAL BEHAVIOR SIMULATIONS OF NANOWIRES IN PHOTOVOLTAIC APPLICATIONS

Nanowires have a large surface-to-volume ratio, which makes them attractive for optical and electronic applications. However, understanding their mechanical behavior is crucial for designing and manufacturing nanowire-based electronic devices. In this project, we used a Finite Element Method (FEM) tool to simulate the effect of pressure (10 N/m2) on various nanowires on two substrates: Glass and PET (polyethylene terephthalate). The nanowire materials used were Gold (Au), Silver (Ag), Nickel oxide (NiO), and Aluminium (Al). Our results show that the maximum strains of Au, Al, Ag, and NiO nanowires were 55%, 50%, 45%, and 30%, respectively. The simulations revealed that NiO was the stiffest, followed by Ag and Al. Au was found to be the most ductile. We also observed that the flexibility of the PET substrate distributed the stress applied to it from the nanowires undergoing deformation on it. This indicates robustness, unlike the glass substrate which was noted to be brittle from the stress and strain graphs obtained from the FEM simulations using the Abaqus/CAE software. Our FEM modeling results demonstrate the flexibility, robustness, and mechanical toughness of nanowires on PET substrates, indicating their effectiveness in fabricating flexible electronics.