**Protection of Transparent Electrodes based on metallic nanowires by nitrides deposited by Plasma-Enhanced ALD**

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Transparent electrodes (TEs) are critical components of many devices in daily life, such as displays, wearable electronics, solar cells, sensors, light-emitting diodes, and many more [1]. They consist of a transparent conductive material (TCM) deposited on a transparent substrate; the main requirement is to exhibit a high optical transmittance and a low sheet resistance. Other essential features like stability, flexibility, uniformity, and cost-effectiveness must be considered. The most studied and used TCM in the last four decades is indium tin oxide (ITO), an n-type semiconductor with 80 % transparency in the visible range and low electrical resistivity (~10−4 Ω⋅m) [2], nevertheless, its ceramic nature and scarcity in the Earth's crust have driven an ongoing race to develop alternative ITO-free TEs for the next generation of flexible electronic devices. In response to this scenario, silver nanowires (AgNWs) assembled within a percolation network are a promising contestant, not only because their physical performance is nearly comparable to ITO but also due to their high mechanical flexibility and compatibility with cost-effective solution-based techniques. However, their performance and integration into devices are limited by their morphological instability caused by the high surface effects [3].

In previous work, we investigated the possibility of coating such Ag nanowires with a robust and stable AlN diffusion barrier by Plasma-Enhanced ALD (PEALD) at 250 °C [4] to prevent the reaction of silver atoms with the environment and their surface diffusion. The current work intends to continue the research at a lower deposition temperature (200°C) and higher growth per cycle (GPC) for a cost-effective approach. The results show that an optimal coating thickness of 3 nm of AlN can resist thermal stress up to 400 °C and electrical stress of 11 V, while the bare nanowires present an irreversible morphological change after 300 °C and 6 V respectively. Regarding the adhesion to the substrate, the bare ones can be easily removed with a force of only 10 mN, in comparison the coated ones remain in the glass substrate even after an applied force of 6 N. Additionally, no optical transmittance loss was exhibited, due to the high optical bandgap of AlN (6.42 Ev), a remarkable asset of this approach.

Nitride-coated silver nanowire networks are TEs that can be integrated into transparent heaters or low-emissivity coatings.

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**Associated references:**

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