PÔSTER - RESUMO - DISPOSITIVOS ELETRÔNICOS, ELETROQUÍMICOS, SUPERCAPACITORES E BATERIAS

LASER-SINTERED ZINC ELECTRODES APPLIED TO SUSTAINABLE ELECTRONICS

Luís Henrique Tigre Bertoldo (luis.bertoldo@unesp.br)

Maíza Da Silva Ozório (maiza.ozorio@unesp.br)

Vinicius Jessé Rodrigues De Oliveira Patzer (vinicius.jesse@unesp.br)

Neri Alves (neri.alves@unesp.br)

The rapid growth of electronic devices has led to a significant increase in electronic waste (e-waste), posing serious environmental and societal challenges due to the presence of hazardous materials and the limited recyclability of conventional electronic components[1]. As a result, sustainable electronics has emerged as a key research area, aiming to reduce environmental impact through the use of eco-friendly materials, low-energy fabrication processes, and biodegradable or recyclable substrates. In this context, alternative electrode materials and scalable processing techniques play a crucial role in enabling greener electronic devices. The sustainable deposition of conductive materials onto environmentally friendly substrates remains a significant challenge. Laser-induced graphene[2], carbon-based inks[3], and metal-based dispersion inks have been explored, with metal-based inks attracting particular attention due to their superior electrical conductivity compared to carbon-based materials. Inks based on dispersions of zinc (Zn)[4], molybdenum (Mo)[4], and iron (Fe)[4] micro- and nanoparticles have been investigated, with Zn standing out because it is a very earth-abundant candidate. Zn dispersion ink can be easily deposited by screen printing, brush coating, and as recently demonstrated by our group, by spray coating. In this work, we demonstrate the fabrication of spray-coated Zn electrodes on kraft paper substrates. These electrodes were applied in an ultraviolet (UV) light sensor by depositing zinc oxide (ZnO) as the active semiconductor layer. The Zn dispersion ink was prepared using polyvinylpyrrolidone (PVP) at a concentration of 20 wt.% dissolved in ethanol. Subsequently, 60 wt.% of Zn microparticle powder was added, and the mixture was stirred for 1 h. A shadow mask defining electrode with dimensions of 1 mm × 10 mm was employed during deposition, with the spray flow rate set to 10 mL/min. After deposition, an acetic acid layer was sprayed onto the Zn surface, followed by laser sintering to promote improved electrical connectivity of the Zn microparticles electrode. To complete the UV light sensor, a dispersion of ZnO nanoparticles (ZnO-NPs) was deposited by spray coating. The Zn electrodes were evaluated using four-probe measurements to extract the sheet resistance, while the morphology was analyzed by scanning electron microscopy (SEM). The sheet resistance exhibited values below 1 Ohm/sq, and the surface showed good uniformity among the Zn microparticles. The UV light sensor demonstrated good performance, and a fast response. These results demonstrate that spray-coated Zn dispersion inks on paper substrates represent a viable approach for low-cost and sustainable electrode fabrication, enabling eco-friendly optoelectronic devices with competitive electrical and photo response performance.

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Palavras-chave: kraft paper; zinc; zinc oxide; sustainable; uv.