

Unique Optical and Electrical Properties of ALD Deposited ZnO on Top of Poly(3-hexylthiophene)

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Atomic layer deposition (ALD) is a thin-film coating technique performed on flat substrates such as silicon and glass. ALD is widely used and known for its conformal coating on solid rough surfaces and trench filling with high aspect-ratio. The gaseous nature of precursors allows them to diffuse into porous substrates and trenches, and for high-quality conformal coating of metal oxides, sulfides, and nitrides.

Another similar process, sequential infiltration synthesis (SIS), inspired by ALD, is used to infuse polymer thin films with inorganic materials. Here, we present the conformal coating of metal oxides on porous thin films via ALD. We are exploiting ALD to investigate

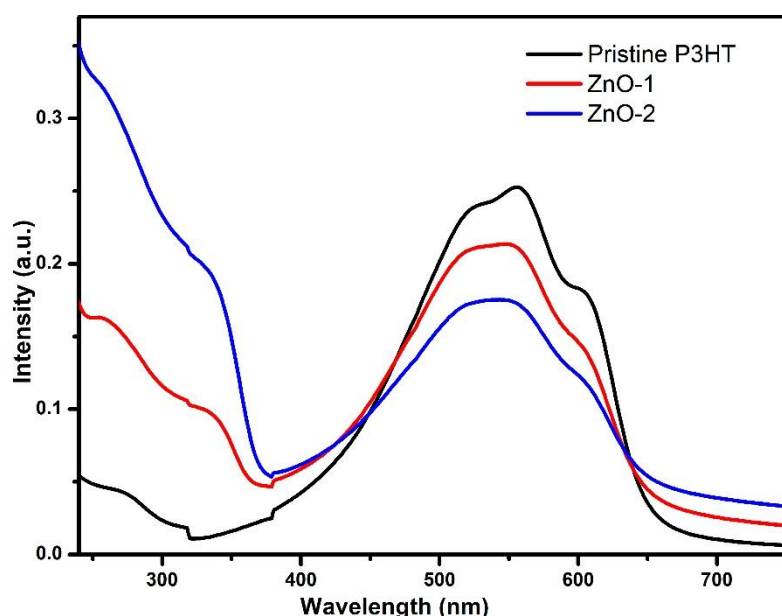


Figure 1: Absorption spectra of P3HT thin film before and after ZnO deposition.

the unique optical and electrical properties of conformally coated metal oxides on porous thin-film polymers. Low-temperature ALD also allows us to use flexible plastic substrates and polymer thin films in the ALD chamber for metal oxide deposition. The sub-surface deposition of metal oxide, along with surface deposition, alters the optical and electrical properties of polymers. The optical absorption spectra of P3HT before and after ZnO deposition are shown in Figure 1. The decrease in the shoulder peak intensity at 603 nm indicates that ZnO is deposited

within the P3HT matrix, thereby distorting the polymer chain ordering.

Researchers explored the chemical interactions of the precursors with various polymer functional groups in the SIS process [1]. Some research groups are exploiting this process towards applications in photolithography [2], solar cells [3], and to improve the mechanical strength of membranes [4]. Wang et al, showed an increase in the conductivity of the P3HT thin film with infiltration of MoCl₅ [5].

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