GROWTH AND STABILITY OF POLY(3,4-ETHYLENEDIOXYTHIOPHENE) THIN FILMS PREPARED BY VAPOR PHASE POLYMERIZATION

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Poly(3,4-ethylenedioxythiophene) (PEDOT) is a conductive polymer characterized by relatively high electrical conductivity and transparency [1]. PEDOT films can be prepared by different methods, including oxidative vapor deposition processes, electrochemical polymerization, coating a mixture containing an oxidant and the monomer or aqueous PEDOT-containing suspension onto substrates [1,2]. During vapor phase polymerization (VPP) an oxidant-covered substrate is placed into an enclosed chamber filled with monomer vapors.

Polymerization conditions and washing the polymerized films influenced conductivity, thickness and optical transmittance of PEDOT films [1]. It was possible to prepare transparent PEDOT film (90% transmittance at 550 nm) with a relatively low sheet resistance (279 Ω/sq). Low humidity in the reaction chamber hindered polymer growth. Washing the freshly prepared PEDOT-oxidant film in an early stage of film formation resulted in a large decrease of sheet resistance, which indicates structural changes in the film occurring due to removal of non-conductive material.

The stability of VPP PEDOT films was investigated at room temperature in different gaseous environments and at elevated temperatures in air and argon [2]. Ultraviolet light, water vapor, vacuum and elevated temperature accelerated the decrease of conductance. Aging of the films was accompanied by characteristic changes in visible and near-infrared absorbance spectra. Temperature dependences of resistance demonstrate that during aging a transition occurs from critical to insulating behavior described by the variable-range hopping model.

References

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