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Article

Correlation of Growth and Surface Properties of Poly(*p*-xylylenes) to Reaction Conditions

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Abstract: Parylene, a non-critical, non-toxic layer material, which is not only a candidate for low-K dielectrics, but also well suited for long-term applications in the human body, has been deposited by (plasma-enhanced) chemical vapor deposition of the monomeric species. To that end, a specially-designed reactor exhibiting a cracker tube at its entrance, which serves as the upstream control, and a cooling trap in front of the downstream control has been applied. The process of polymerization has been traced and is explained by evaporating the dimeric species followed by dissociation in the cracker at elevated temperatures and, eventually, to the coating of the polymeric film in terms of thermodynamics. Alternatively, the process of dissociation has been accomplished applying a microwave plasma. In both cases, the monomerization is controlled by mass spectrometry. The window for surface polymerization could be clearly defined in terms of a factor of dilution by an inert gas for the chemical vapor deposition (CVD) case and in the case of plasma-enhanced chemical vapor deposition (PECVD), additionally by the power density. The characterization of the layer parameters has been carried out by several analytical tools: scanning electron microscopy and atomic force microscopy to determine the surface roughness and density and depth of voids in the film, which influence the layer capacitance and deteriorate the breakdown voltage, a bulk property. The main issue is the conduct against liquids between the two borders' hydrophilic and hydrophobic conduct, but also the super-hydrophobic character, which is the condition for the Lotus effect. The surface tension has been evaluated by contact angle measurements. Fourier-transform infrared spectroscopy has proven the conservation of all of the functional groups during polymerization.