

Adsorption Behavior of Hydrophobically Modified Polyelectrolytes onto Amino- or Methyl-Terminated Surfaces

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Abstract

The adsorption of hydrophobically modified polyelectrolytes derived from poly(maleic anhydride-alt-styrene) (P(MA-alt-St)) containing in their side chain aryl-alkyl groups onto amino- or methyl-terminated silicon wafers was investigated. The effect of the spacer group, the chemical nature of the side chain, molecular weight of polyelectrolyte, and ionic strength of solution on the polyelectrolyte adsorbed amount was studied by null ellipsometry. The adsorbed amount of polyelectrolyte increased with increasing ionic strength, in agreement with the screening-enhanced adsorption regime, indicating that hydrophobic interactions with the surface play an important role in the adsorption process. At constant ionic strength, the adsorbed amount was slightly higher for polyelectrolytes with larger alkyl side chain and decreased with the hydrophobicity of aryl group. The adsorption behavior is discussed in terms of the side chain flexibility of the polymer. Characteristics of the adsorbed layer were studied by atomic force microscopy (AFM) and contact angle measurements. AFM images show the presence of aggregates and closed globular structure of polyelectrolyte onto the amino- or methyl-terminated surface, which agrees with a 3D and 2D growth mechanism, respectively. Fluorescence measurements showed that the aggregation of polyelectrolyte containing the hydrophobic naphthyl group occurs already in the solution. However, the aggregation of polyelectrolytes containing the phenyl group in its side chain is not observed in solution but is induced by the amino-terminated surface. This difference can be explained in terms of the higher flexibility of side chain bearing the phenyl group. The polyelectrolyte films showed a high chemical heterogeneity and moderate hydrophobicity.

Keywords

Adsorption, Ionic strength, Molecular mechanics, Hydrophobicity, Polyelectrolytes.