

Glass Transitions of Amorphous Polymers Confined in Nanopores: Dependence on Interfacial Energy and Thickness

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We report on the influence of confinement on the segmental dynamics of a series of amorphous polymers (PVA_c, PB, PS, PDMS, PMPS, Glycerol, PMMA and PI) and of two semicrystalline polymers (PEO and PCL). The confining medium is always the same, namely, self-ordered anodic aluminum oxide, abbreviated as AAO. AAO templates contain arrays of discrete-isolated, parallel, cylindrical pores that are uniform in length and diameter that have been employed as model confining systems. Dielectric spectroscopy reveals that dynamics become faster in confinement and thus a large depression in glass temperature is generally observed with decreasing pore diameter. In a second step we are exploring a possible connection of the glass temperature in the pores with the interfacial energy. To this end, the interfacial energy between the different polymers and AAO surface is calculated by means of the Fowkes-Oss-Chaudhury model. We find a general relation of the depression in glass temperature with increasing interfacial energy. Additional effects could relate to the density near the pore walls and surface roughness.