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Equilibrium flattening process of irreversibly adsorbed polymer chains on a solid[1] MANI SEN, Materials Science and Engineering (MSE),Stony Brook University (SBU),NY, NAISHENG JIANG, MAYA ENDOH, TADANORI KOGA, MSE,SBU, DAISUKE KAWAGUCHI, KEIJI TANAKA, Kyushu University,Japan — We here report the equilibrium process of adsorbed polymer chains on a solid by sum frequency generation (SFG) spectroscopy. Polystyrene (PS,M_{w} = 290 kDa) thin films prepared onto quartz prisms (a weakly attractive system) were used as a model system. Spin-cast PS 50 nm films on quartz surface (QS) were annealed at 150 C $>T_{\mathrm{g}}$ for up to 100 h and subsequently rinsed with chloroform to derive the "flattened chains" that lie flat onto the substrate surface. The SFG results for the "matured" flattened chains after annealing for 96 h revealed the strong interfacial orientation of the backbone chains and weak orientation of PS phenyl rings at the QS which is in contrast to a PS spin-cast film annealed at 150 C for 1 h: the phenyl rings were strongly directed toward the QS, while the backbone chains were weakly orientated at the QS. We postulate that the increase in the number of solid/segment contacts of the backbone chains is the driving force for this equilibrium flattening process. We will also discuss the generality of this flattening process by using solvent-cast PS thin films where the chains are randomly oriented near the QS.

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