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Time- and Frequency-Domain Surface Spectroscopy of Polymers and Langmuir-Blodgett films ANDREY BORDENYUK, HIMALI JAYATHILAKE, ALEXANDER BENDERSKII, Wayne State University — We combine frequency- and femtosecond time-domain IR+visible Sum Frequency Generation (SFG) measurements for spectroscopic characterization of material surfaces. Vibrational quantum beats observed in Langmuir-Blodgett monolayers are demonstrated to be sensitive to the molecular order/disorder in the film, depending on the two-dimensional phase. Nearly vertical alignment of all-trans alkyl chains is observed in films transferred at high surface pressure, while at lower surface pressure, changes in chain tilt angle and onset of gauche-defects are observed. The time- and frequency-domain data are analyzed simultaneously based on optical Bloch equations, allowing to utilize the information redundancy for more accurate determination of the spectral parameters. Polymer surfaces used as alignment layers in liquid crystal displays were investigated to elucidate how the mechanical rubbing affects the molecular orientation and conformation. Rubbing was found to induce pronounced azimuthal anisotropy of the alkyl side chain orientation, observed in the CH-stretch SFG spectra of the CH_3 and CH_2 groups. Orientational analysis of the SFG vibrational spectra as a function of azimuthal and tilt angles (in- and out-of-surface plane) of the polymer side chains shows their preferential tilt along the rubbing direction.

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