DNA-FUNCTIONALIZED SILICA SURFACES STUDIED BY NONLINEAR OPTICAL SPECTROSCOPY

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We use the surface-specific nonlinear optical spectroscopy broadband sum frequency generation (SFG) to study DNA single and double strand oligomers that are covalently attached to the surfaces of glass microscope slides through amide linker silanes. Polarization-resolved SFG studies of thymine- and adenine-containing 15-mer single and double strands yield detailed molecular information concerning the chirality of the stereogenic centers and the secondary structure. Using chiral polarization combinations, we obtain SFG spectra that can be viewed as second-order vibrational analogs of circular dichroism spectra. Using our SFG spectra of oligonucleotide single and double strands, we assessed surface order and observed vibrational signatures from stereogenic carbon atoms on the ribose sugar groups as well as molecular chirality upon double helix formation following hybridization from the thymine moieties. We believe that the label-free molecularly specific nature of these measurements will assist in biodiagnostics applications and enhance the fundamental characterization of surfaces modified with biopolymers.