

Supplementary Information for: “Performance Comparison of 3D-Printed Terahertz Waveplates Fabricated from PLA, ABS, and HIPS”

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S1. COMPARISON OF FILAMENTS REFRACTIVE INDICES

Supplementary Table 1. Sub-1 THz refractive index values for HIPS, ABS, and PLA. See Ref. [2] for a more comprehensive data compilation.

HIPS	ABS	PLA	Ref.
1.48	1.47	1.54	Brodie <i>et al.</i> [3]
1.56	1.57	1.89	Busch <i>et al.</i> [4]
1.48	1.49	1.56	Squires <i>et al.</i> [5]
1.53	1.61	1.60	Our results

S2. STOKES FORMALISM

The THz electric field polarization state in cartesian coordinates (E_x, E_y) can be converted to the circular basis (E_r, E_ℓ) through:

$$E_r = \frac{1}{\sqrt{2}}(E_x - iE_y), \quad E_\ell = \frac{1}{\sqrt{2}}(E_x + iE_y), \quad (\text{S1})$$

respectively, the right- and left-handed circular polarization components. The complete polarization state is described by the Stokes parameters [31]:

$$S_0 = |E_r|^2 + |E_\ell|^2 \quad (\text{S2})$$

$$S_1 = 2 \operatorname{Re}(E_r E_\ell^*) \quad (\text{S3})$$

$$S_2 = 2 \operatorname{Im}(E_r E_\ell^*) \quad (\text{S4})$$

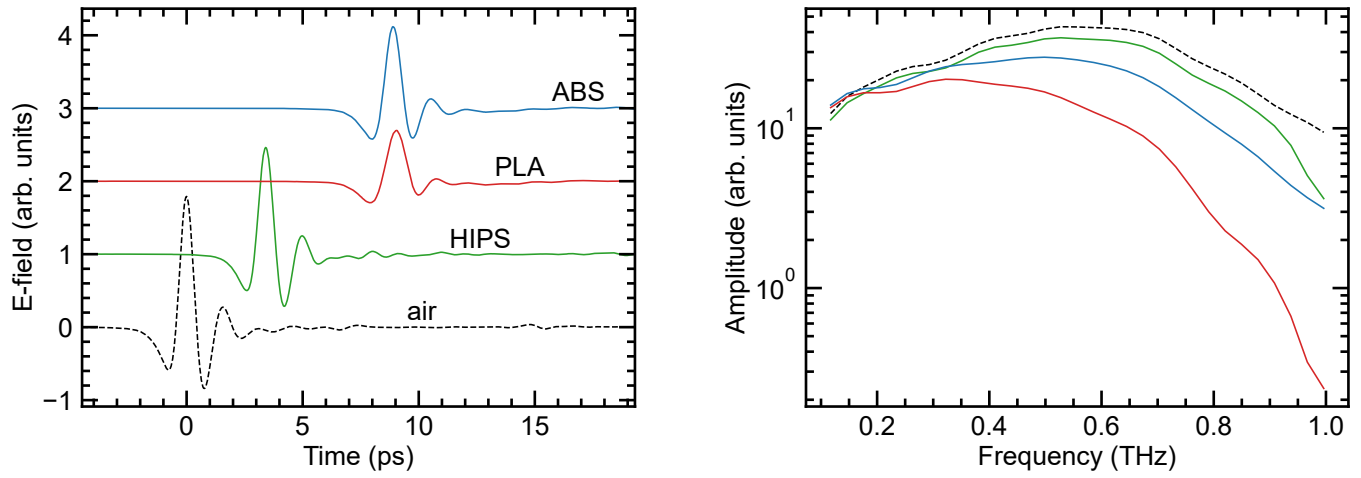
$$S_3 = |E_r|^2 - |E_\ell|^2 \quad (\text{S5})$$

where S_0 represents total intensity, S_1 and S_2 describe linear polarization, and S_3 corresponds to circular polarization. The rotation angle θ and ellipticity η are obtained from Stokes parameters as:

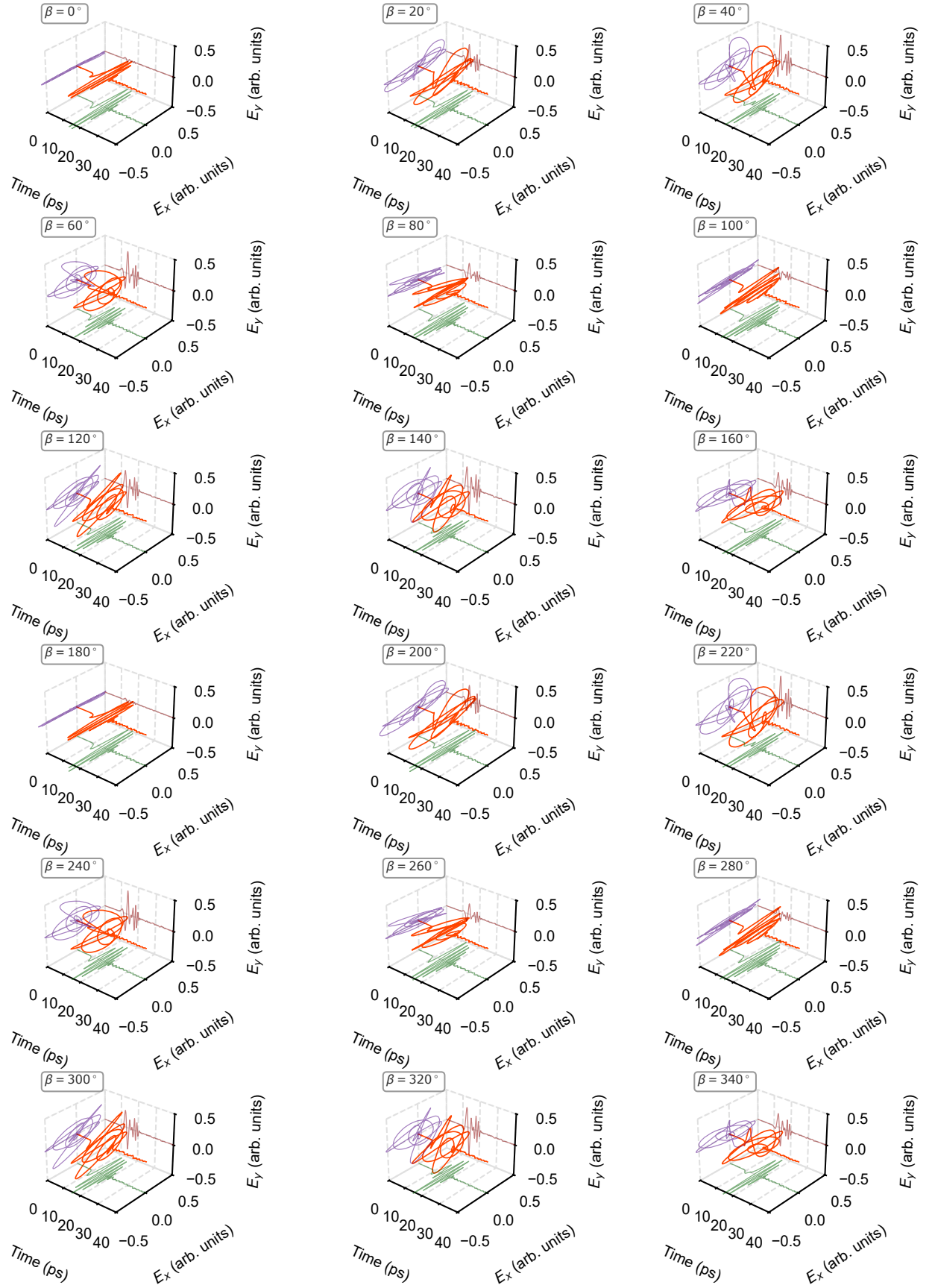
$$\theta = \frac{1}{2} \operatorname{atan2}(S_2, S_1) \quad (\text{S6})$$

$$\eta = \frac{1}{2} \arcsin(S_3/S_0). \quad (\text{S7})$$

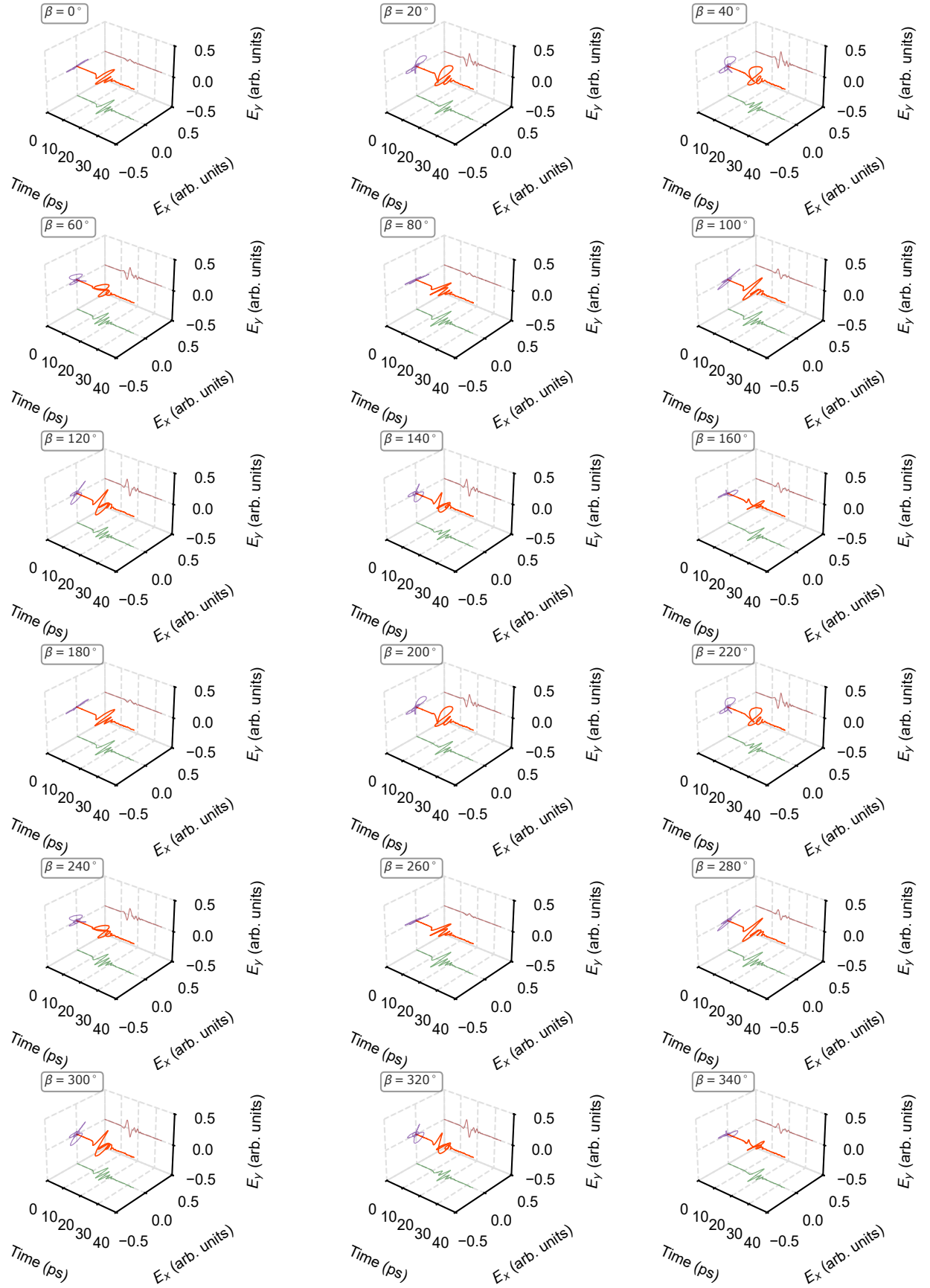
S3. MEASURED THZ WAVEFORMS



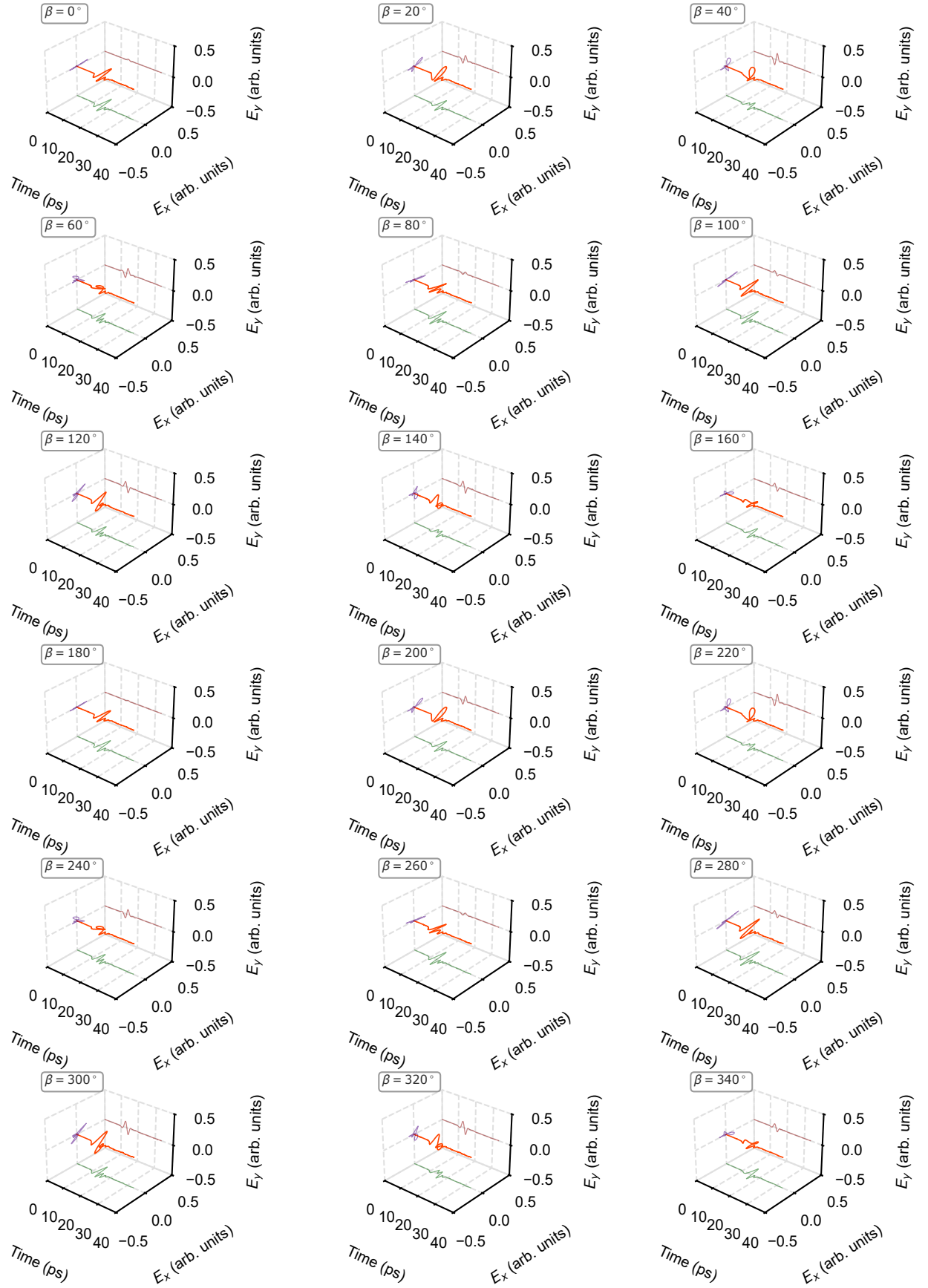
Supplementary Figure 1. Terahertz transmission pulses and their frequency spectra for 2 mm HIPS (green), PLA (red), and ABS (blue): (a) time-domain THz pulses measured via THz-TDS; (b) corresponding amplitude spectra obtained by FFT of the time traces.



Supplementary Figure 2. Time-domain waveforms of the transmitted THz field, showing full polarization states extracted via orientation-dependent THz-TDS of the HIPS waveplate.



Supplementary Figure 3. Time-domain waveforms of the transmitted THz field, showing full polarization states extracted via orientation-dependent THz-TDS of the ABS waveplate.



Supplementary Figure 4. Time-domain waveforms of the transmitted THz field, showing full polarization states extracted via orientation-dependent THz-TDS of the PLA waveplate.