All-dielectric phase-change reconfigurable metasurface: Supplemental Material

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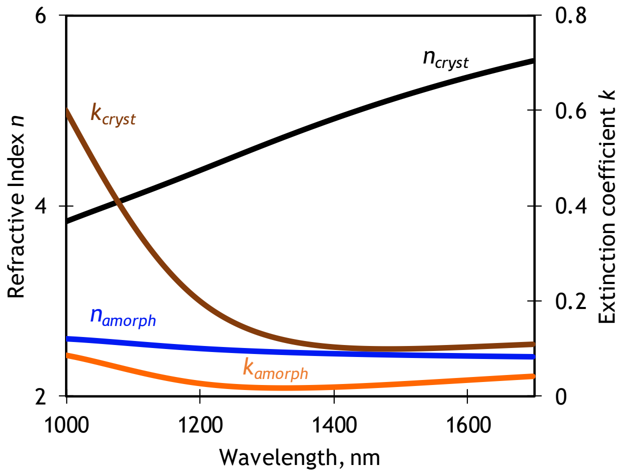

Figure S1. Near-IR dispersion of complex refractive indices, from spectroscopic ellipsometry, of the as-deposited amorphous and laser-annealed crystalline phases of a 300 nm thick unstructured Ge:Sb:Te film on silica.

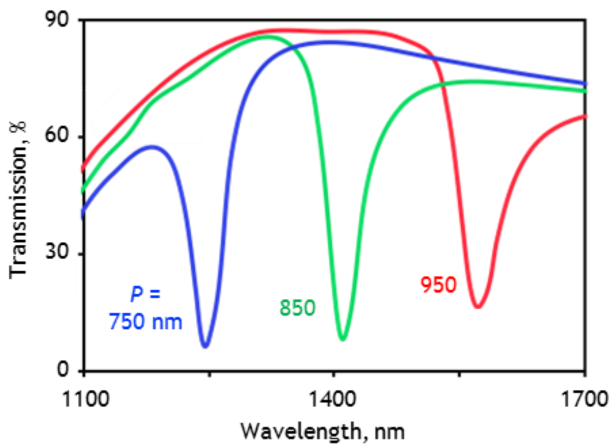

Figure S2. Numerically simulated transmission spectra for 300 nm thick amorphous GST nano-grating metamaterials with a selection of periods [as labelled; slot width *s* = 130 nm], under TE-polarized illumination, calculated using ellipsometircally measured values for the [weakly dispersive] complex refractive index of unstructured amorphous GST.

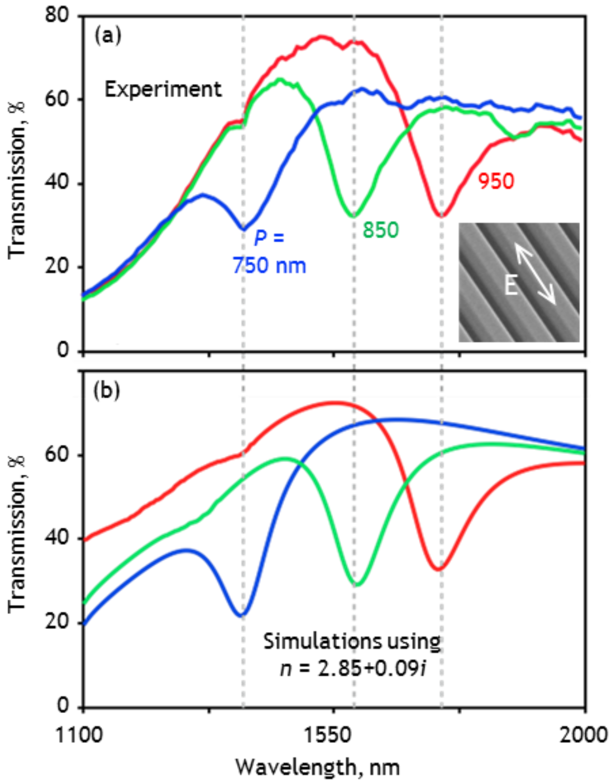

Figure S3. (a) Microspectrophotometrically measured transmission spectra for 300 nm thick laser-annealed [partially] crystalline GST nano-grating metamaterials with a selection of periods *P* [as labelled; slot width *s* = 130 nm], under TE-polarized illumination. (b) Corresponding numerically simulated transmission spectra calculated using a non-dispersive GST refractive index value of 2.85 + 0.09*i* that reproduces the experimental resonance positions and widths for all grating periods.

TM-polarized illumination

Under TM-polarized illumination nano-grating resonances are split (Supplementary Fig. S4) as a result of the structures' strong sensitivity in this orientation to the incident angle of light: The microspectrophotometer employs an objective with a numerical aperture of 0.28, thereby illuminating samples at incident angles θ

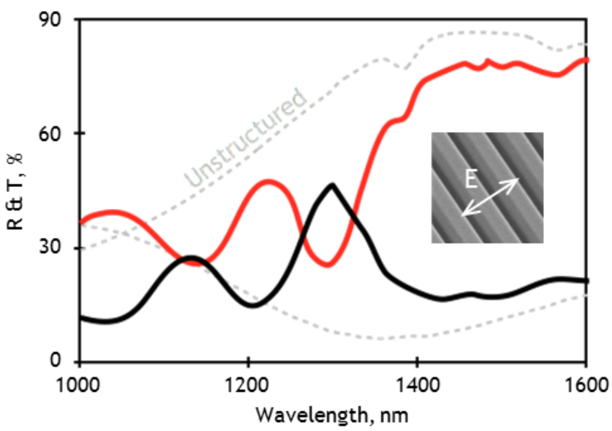

Figure S4. Microspectrophotometrically measured reflection and transmission spectra for a 300 nm thick amorphous GST nano-grating metamaterial with a period *P* = 750 nm [slot width *s* = 130 nm], under TM-polarized illumination.

ranging from zero and ~16°. This is of little consequence to the TE mode (experimental data are reproduced well by numerical simulations assuming ideally normal incidence), but for the TM polarization spatial symmetry is broken by the slightest deviation from normal incidence, leading to the observed resonance splitting.[1, 2] The TM resonances are characterized by displacement currents circulating in the *xz* plane (forming magnetic dipoles oriented along *y*) – a single symmetric loop centered within each nanowire at singularly normal incidence, $\theta = 0°$; more complex asymmetric double-loop distributions at off-normal angles (Supplementary Fig. S5).

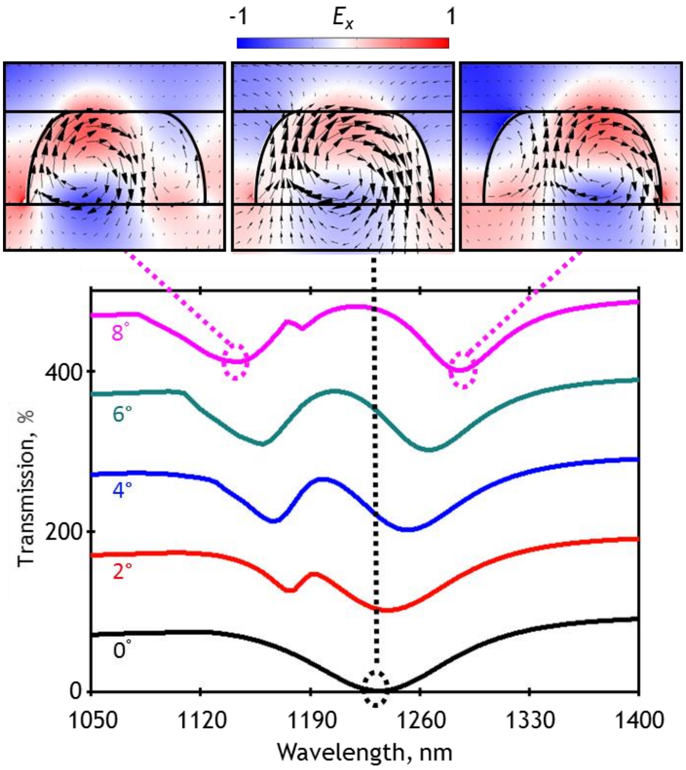

Figure S5. Numerically simulated TM-mode transmission spectra for a 300 nm thick GST nano-grating metamaterial, with a period P = 750 nm and slot width at the lower and upper surfaces of the GST layer of 130 and 450 nm respectively, for incident angles between 0º and 8º [as labelled; vertically offset for clarity]. Field maps above show the distribution of the x-component of electric field in the *xz* plane for a unit cell of the metasurface at the singular normal incidence resonance [λ = 1235 nm] and the two minima [= 1145 and 1285 nm] of the split resonance for an incident angle of 8º.

1. A. Christ, S. G. Tikhodeev, N. A. Gippius, J. Kuhl and H. Giessen, Phys. Rev. Lett. **91**, 183901 (2003).
2. D. L. Brundrett, E. N. Glytsis and T. K. Gaylord, Opt. Lett. **23**, 700-702 (1998).