Nanopatterning of GeTe Phase Change Films via Heated-Probe Lithography: Supplementary Information

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Optical constants for the amorphous as-deposited and crystalline GeTe films were extracted from spectral ellipsometry measurements acquired on ~620 nm GeTe films deposited on fused silica. Crystalline films were obtained by annealing as-deposited samples at 250 °C for 10 minutes in an argon atmosphere. A J.A. Woollam spectral ellipsometer (reflection mode) was used to measure the optical properties of the films from ~200 nm to 1700 nm, with subsequent modeling enabling extraction of the index of refraction, n, and extinction coefficient, k, of the GeTe as shown in Figure S1, in excellent agreement with previously reported optical properties of similar GeTe films [ref. S1].

The fraction of light transmitted, T, through a single layer, with constant absorption coefficient, α, and thickness, L, is expressed as [ref. S2]

$$T = e^{-\alpha L} \tag{S1}$$

For a system with a position-dependent absorption coefficient, the general form becomes

$$T = e^{\left(-\int \alpha(l)dl\right)} \tag{S2}$$

The system treated in our work consists of two films with a sum total thicknesses of L and individual thicknesses of $L*p$ and $L*(1-p)$, where p is the fraction of total film thickness converted from amorphous to crystalline. According to Eq. S2, the absorption of such a stack would then be

$$T = e^{-\{\alpha_c Lp + \alpha_a L(1-p)\}} \quad \text{(S4)}$$

Given that $\alpha = 4\pi\nu k$, where ν is frequency and k the extinction coefficient extracted from ellipsometry, one arrives at Eq. 1 as given in the main text:

$$T = e^{-4\pi\nu\{k_c Lp + k_a L(1-p)\}} \quad \text{(S5)}$$

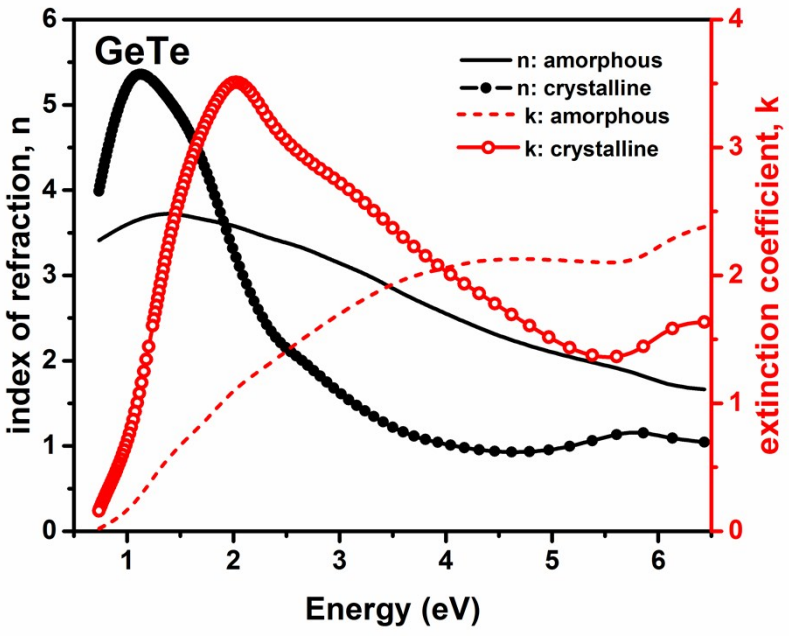

Figure S1: GeTe index of refraction, n (left axis) and extinction coefficient, k (right axis) extracted from spectral ellipsometry measurements on amorphous and crystalline thin films.

Supplementary Information References

[S1] Park, J.W.; Baek, S.H.; Kang, T.D.; Lee, H.; Kang, Y.-S.; Lee, T.-Y.; Suh, D.-S.; Kim, K.J.; Kim, C.K.; Khan, Y.H.; Da Silva, J.L.F.; Wei, S.-H., *Applied Physics Letters* **2008,** *93,* 021914

[S2] M. Born and E. Wolf, *Principles of Optics*, Cambridge University Press, UK, 7th edn., 1999, p. 219.