Ultrathin Semiconductor Superabsorbers from the Visible to the Near Infrared

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The design of ultrathin semiconducting materials that achieve broadband absorption is a long-sought-after goal of crucial importance for optoelectronic applications [1]. To date, attempts to tackle this problem consisted either on the use of strong -- but narrowband – or broader --but moderate -- light trapping mechanisms. In this work, we present a strategy that achieves broadband optimal absorption in arbitrarily thin semiconductor materials for all energies above their bandgap. This stems from the strong interplay between Brewster modes [2], sustained by judiciously nanostructured thin semiconductors on metal films, and photonic crystal modes. We demonstrate broadband near-unity absorption in Ge ultrathin films that extend from the visible to the Ge bandgap in the near infrared and robust against angle of incidence variation [3]. Our strategy follows an easy and scalable fabrication route enabled by soft nanoimprinting lithography [4], a technique that allows seamless integration in many optoelectronic fabrication procedures.

References

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[3] P. Molet, J. L. Garcia-Pomar, C. Matricardi, M. Garriga, M. I. Alonso, A. Mihi, Adv Mat DOI: 10.1002/adma.201705876 *In Press*
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Figures

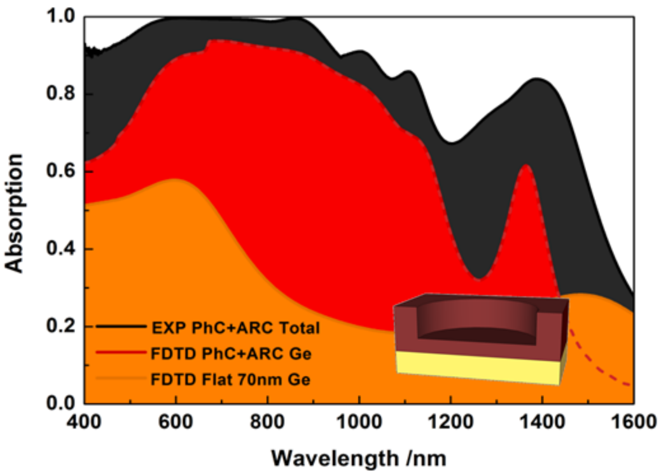

Figure 1: Total absorption of the Nanostructured 70 nm dielectric superabsorber (Black) and absorption in the Germanium (Red) vs the absorption of a flat film of germanium over gold with the same thickness (70 nm) (Orange). Inset: Cross section scheme of the photonic structure.

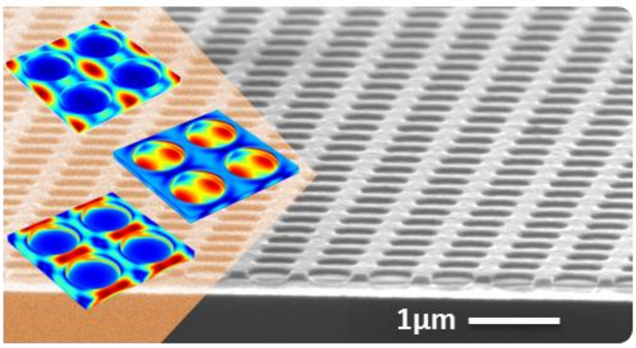

Figure 2: SEM Tilted cross-section image of the photonic architecture and the electric field concentration for its maximum absorption peaks.