Shaping Light with Matter: Advanced Materials Driving the Future of Nanophotonics

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Advanced materials—ranging from nanostructured coatings and bio-inspired surfaces to multifunctional composites— are finding impact across energy, sensing, and biomedical technologies through their unique properties at the nanoscale. At the Advanced Materials Research Center (AMRC), our efforts are directed towards the design and realization of metamaterials, self-healing coatings, and robust composites that combine optical, mechanical, and functional properties for operation in extreme environments.
In nanophotonics, these material advances translate directly into functional devices. Engineered structures now enable precise subwavelength control of phase and polarization [1-2], producing tailored spectral responses that are central to energy harvesting, optical sensing, and biomedical imaging. Our strategy is to integrate material innovation with applied photonic technologies by advancing durable coatings for harsh environments, multifunctional metasurfaces for optical integration [3-4], and bio-inspired devices with imaging and anti-fouling capabilities [5]. These developments define a materials-driven pathway towards scalable and multifunctional photonic platforms, offering direct relevance to industrial deployment and biomedical integration.

References

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