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Anomalous retroreflection from strongly absorbing nanoporous semiconductors

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Abstract

Pronounced retroreflection behavior is reported for a fishnet nanoporous strongly absorbing semiconductor material. Retroreflection features a half-cone about 0.35 rad along with diffusive specular reflection for all angles of incidence. Retroreflection is apparent by the naked eye with daylight illumination and exhibits no selectivity with respect to wavelength and polarization of incident light featuring minor depolarization of retroreflected light. The reflectance in the backward direction measures 12% with respect to a white scattering etalon. The phenomenon can be classified neither as coherent backscattering nor as Anderson localization of light. The primary model includes light scattering from strongly absorptive and refractive superwavelength clusters existing within the porous fishnet structure. A reasonable qualitative explanation is based on the fact that strict retroreflection obeys shorter paths inside absorbing medium, whereas all alternative paths will lead to stronger absorption of light.