Self-assembly of predesigned optical materials in nematic codispersions of plasmonic nanorods

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Optical metamaterials and other nanostructured metal-dielectric composites hold great potential for designing and practically realizing novel types of light–matter interactions. Here we develop an approach to fabricate composites with tunable pre-engineered properties via self-assembly of anisotropic nanoparticles codispersed in a nematic liquid crystal host. Orientations of plasmonic nanorods of varying aspect ratios are controlled to align parallel or perpendicular to the nematic director and retain this relative orientation during a facile electric switching. The ensuing dynamic reconfigurability of the surface plasmon resonances of a composite enables a previously inaccessible means of controlling light and may enable tunable plasmonic filters and polarizers. 2016 A

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N 1( )

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1. %. ( )

≈530 nm

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1( ) P

AC U (1 ( ),

P||N0

A P⊥N0,

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N

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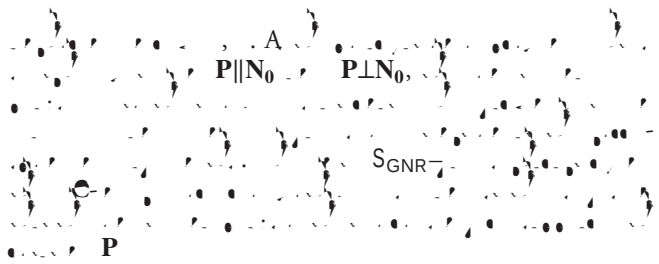
SGNR = ⟨3 cos2 θGNR − 1)/2)

A|| A⊥ P||N0

P⊥N0 SGNR =(A|| − A⊥)/(A|| + 2A⊥),

SLGNR =

0.58 SSGNR = 0.50,


A
P||N0
P⊥N0,
SGNR
P