

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

GHADAH H. SHEETAH,<sup>1,2</sup> QINGKUN LIU,<sup>1,2</sup> AND IVAN I. SMALYUKH<sup>1,2,3,4,\*</sup>

<sup>1</sup>Materials Science and Engineering Program, University of Colorado, Boulder, Colorado 80309, USA

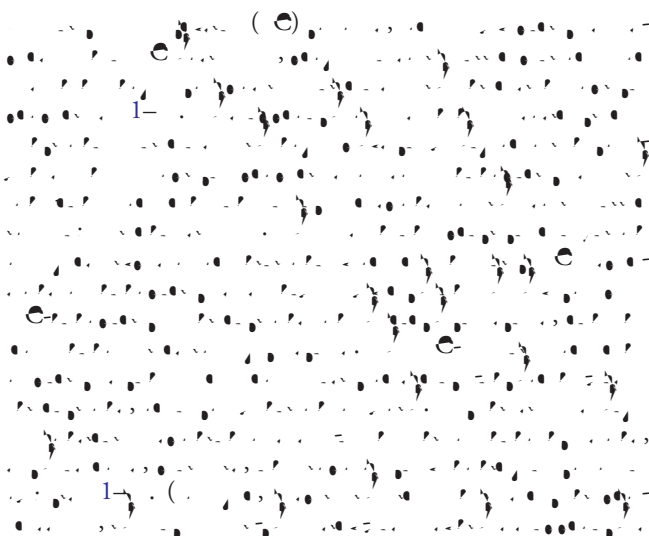
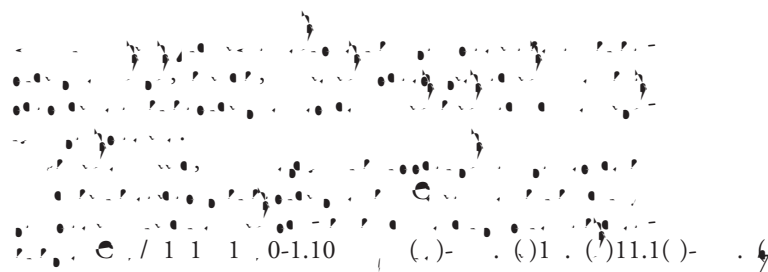
\*Corresponding author: [ivan.smalyukh@colorado.edu](mailto:ivan.smalyukh@colorado.edu)

Received 18 July 2016; revised 18 September 2016; accepted 21 September 2016; posted 22 September 2016 (Doc. ID 270800); published 20 October 2016

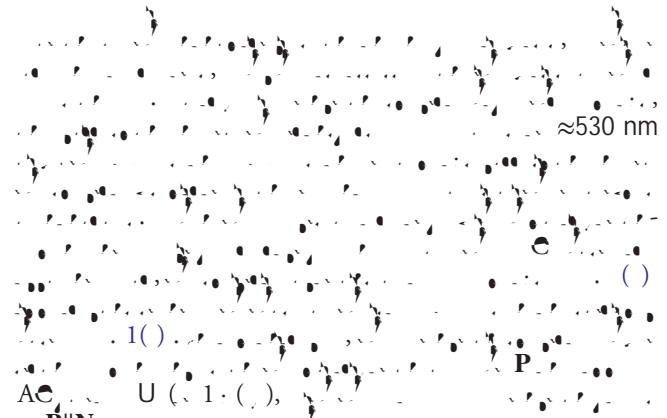
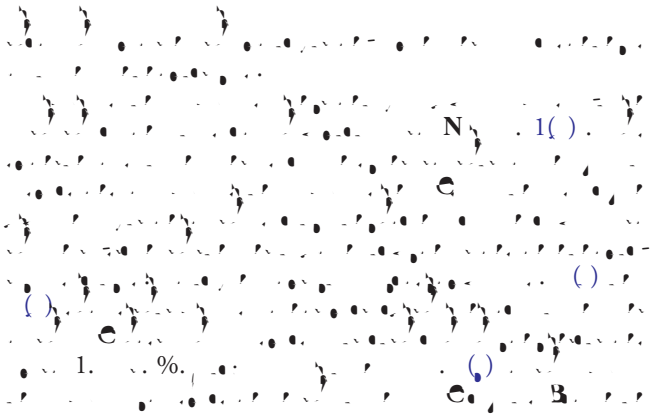
Optical metamaterials and other nanostructured metal-dielectric composites hold great potential for designing and practically realizing novel types of light-matter interactions. Here we develop an approach to fabricate composites with tunable pre-engineered properties via self-assembly of anisotropic 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 Optical Society of America

**OCIS codes:** (160.3710) Liquid crystals; (250.5403) Plasmonics.

<https://doi.org/10.1364/OE.11.004899>







$S_{\text{GNR}} = (3 \cos^2 \theta_{\text{GNR}} - 1) / 2$   
 $S_{\text{GNR}} = (A_{\parallel} - A_{\perp}) / (A_{\parallel} + 2A_{\perp})$   
 $S_{\text{LGNR}} = 0.58$ ,  $S_{\text{SGNR}} = 0.50$

