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Novel Applications of Plasmonic Bowtie Nanoantennas in the Presence of Heating

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Abstract:

Two-dimensional arrays of gap, plasmonic nanoantennas have been a topic of increasing interest in recent years, primarily because of their attribute of enhancing the intensity of light by as much as 10^3 times over small, nanometer-sized, spatial regions. Concomitant with this local field enhancement, which is optimized under resonant optical illumination, is significant local significant (Joule) heating of the nanoantennas. While typically heating in plasmonic systems is viewed as an unwanted lossy mechanism, in recent years, various research groups have investigated harnessing this property in novel ways. In the case of the PROBE lab at the University of Illinois at Urbana-Champaign, we have focused on the use of arrays of either gold bowtie nanoantennas (BNAs), or (dielectric) pillar-supported gold bowtie nanoantennas (pBNAs). Using either BNAs or pBNAs as platforms, the PROBE lab has investigated 3 primary applications that leverage enhanced local heating: optical nanotweezers, near-field optical recording, and plasmon assisted etching. In this talk, we highlight select applications from low-input optical power density tweezing to fabrication of planar optical components.

Bio

Kimani C. Toussaint, Jr. is an Associate Professor in the Department of Mechanical Science and Engineering, and an Affiliate Faculty in the Departments of Electrical and Computer Engineering, and Bioengineering, as well as the Beckman Institute for Advanced Science and Technology at the University of Illinois at Urbana-Champaign (UIUC). Dr. Toussaint directs the laboratory for Photonics Research of Bio/nano Environments (PROBE Lab) at UIUC, an interdisciplinary research group which focuses on developing advanced optical techniques for both quantitatively imaging collagen-based biological structures, and investigating the optical properties of plasmonic nanostructures for light-driven control of matter Dr. Toussaint is a recipient of a 2010 NSF CAREER Award, the 2015 UIUC Dean's Award for Excellence in Research, and holds Senior Member positions in the OSA, IEEE, and SPIE. He has previously been selected for both the National Academy of Science's 18th Annual Kavli Frontiers of Science Symposium, and the 8th Annual National Academies Keck Futures Initiative on Imaging Science. In addition, Dr. Toussaint has appeared on the UIUC List of Teachers Ranked as Excellent by Their Students numerous times due to his commitment to teaching. From May 2014 – June 2015, Dr. Toussaint was on sabbatical at MIT as a Dr. Martin Luther King, Jr. Visiting Associate Professor in the Department of Mechanical Engineering.