Femtosecond laser irradiation for hot spots mapping on the surface of plasmonic nanostructures

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Abstract

In this research, we present a novel method for visualising plasmonic `hot spots` upon plsmonic surfaces of gold nanostructures. Femtosecond laser pulses have been used to map the locations of localised high intensity electromagnetic fields i.e. the locations of hot spots. Upon irradiation with 800 nm femtosecond laser pulses, which may be linearly or circularly polarised, it is possible to reveal the locations of plasmonic hot spots since the nanostructures are physically damaged i.e. undergo melting by the intense heat generated by femtosecond laser pulse irradiation [1, 2]. SEM microscopy was used subsequently to map the surface of the nanostructures to show which areas have been damaged, and hence reveal the locations of the hot spots. 2D arrays of quadric units (arranged in a racemic fashion) consisting of two patterns: gammadions and G-like shapes, have been used as plasmonic chiral nanostructures. It has been found that irradiation with linearly polarised light affected segments that are perpendicular to the polarisation direction of the incident beam. However, irradiation with circularly polarised light affected both horizontal and vertical segments of the nanostructures regardless the sense of individual features (i.e. left-handed or right-handed) or the sense of the circular polarisation of the incident beam (i.e. clockwise or counter-clockwise). Hence, no enantio-selectivity was observed.

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Biography

Nadia A. Abdulrahman has completed her PhD on Aug. 2014 at the age of 41 at University of Glasgow- College of Science and Engineering-School of Chemistry/UK. She is a lecturer of physical chemistry and has been serving as an academic at University of Baghdad-College of Science-Department of Chemistry/Iraq. She has published six papers in Iraqis, British and Americans journals. During her PhD course and afterword, she had learned: how to design and fabricate 2D chiral and achiral plasmonic nanostructures (metamaterials) via nanofabrication technology, how to use SEM and AFM microscopy for metamaterials and biological molecules imaging, running UV and CD spectroscopy for metamaterials and biological molecules characterization, running SHG spectroscopy to characterize non-linear optical activity of 2D chiral plasmonic metamaterials, using femtosecond Laser irradiation to map Hot-Spots on the surface of chiral plasmonic metamaterials and using XRD spectroscopy and Williamson-Hall analysis to characterize crystal lattice of nanoparticles. In addition, she has learned the principles of scientific writing and hence, starts reviewing scientific articles, papers and theses.