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PHOTOCHEMICAL IMAGING OF NEAR-FIELD AND DISSYMMETRY FACTOR IN CHIRAL NANOSTRUCTURES

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Chiral nanostructures interact differently with right and left circularly polarized light. Moreover, they exhibit enhanced electric and magnetic near-fields leading to the so-called superchirality. This effect can be used for the detection of chiral biological objects with high enantio-sensitivity. Indeed, the optical chirality C is correlated with the rate of excitation of the chiral molecule [1], so that increasing the optical chirality at the location of the molecule can significantly improve its detection [2]. We present here a subwavelength imaging approach that is based on the interaction between the highly exalted near-field of chiral nanoparticles and an azobenzene molecule (DR1, disperse red 1) grafted to a polymeric chain (i.e. PMMA). Under illumination, the azobenzene molecules (DR1) undergo photo-isomerization cycles, which induce a displacement of matter inducing measurable topographical modifications that can be tracked using atomic force microscopy. Therefore, we obtain in the polymer a map of the near-field of the chiral nanostructures [3]. We recently demonstrated that chiral effects and field dissymmetry in plasmonic nanostructures can be imaged with this technique [4]. Here, we apply photochemical imaging to chiral metallic nanostructures composed of two coupled gold nanorods. Each rod has a length of 140 nm, a width of 70 nm and a height of 50 nm. They are separated by a 30 nm wide gap and are shifted with respect to each other by a distance '***S***' along their long axis. We show that the near-field chiral response can be imprinted in the photopolymer. It is shown that it is possible to experimentally map the near-field dissymmetry factor, which is the contrast in the local near-field response of the object under RCP and LCP excitation.

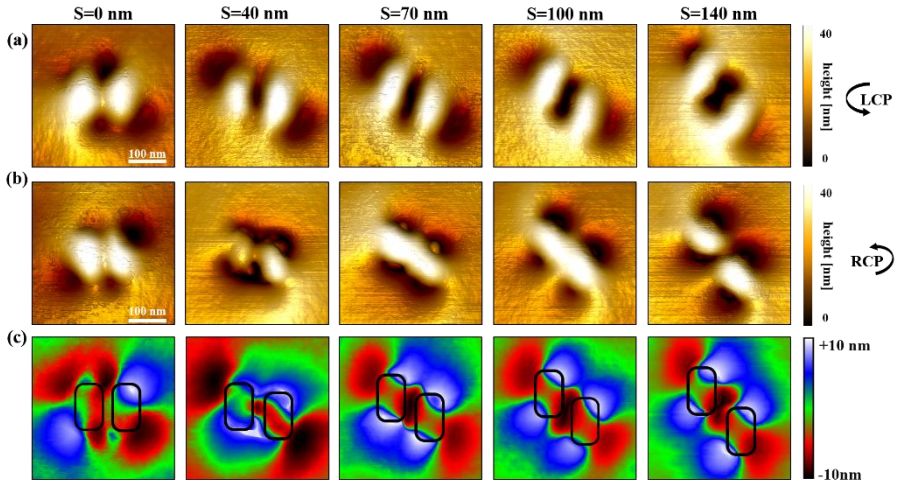

Figure 1. (a,b) AFM images after irradiation by the left (LCP) and right (RCP) polarization. (c) V-factor maps.

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