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Contents

Original Article

This work enriched a variety of hierarchical microstructures composed of microgrooves and high spatial frequency laser induced periodic surface structures (HSFLs) by femtosecond (fs) laser (pulse duration: 457 fs, wavelength: 1045 nm, and repetition rate: 100 kHz) in liquids (water and acetone) at relatively high laser fluence of 1.7 J/cm^2. The periods of Si-HSFLs in the range of 110-200 nm are independent of the scanning speeds (0.1, 0.5, 1 and 2 mm/s), line intervals (5, 15 and 20 μm) of scanning lines and scanning directions (perpendicular or parallel to light polarization direction). Besides normal HSFLs whose orientation is perpendicular to the direction of light polarization, both clockwise and anticlockwise randomly tilted HSFLs with a maximal deviation angle of 50° as compared to those of normal HSFLSs are found on the microstructures with height gradients. It is considered that surface melting and nanocapillary waves play important roles in the formation of Si-HSFLs. The result by laser ablation in air that produces no HSFLs indicates that moderate melting facilitated with ultrafast liquid cooling is beneficial for the formation of HSFLs by fs-LALs. Based on our findings and previous reports, the formation mechanism for HSFLs at high fluence was proposed and discussed, including thermal melting with the concomitance of ultrafast cooling in liquids, transformation of the molten layers into ripples and nanotips by surface plasmon polaritons (SPP) and second-harmonic generation (SHG), and modulation of Si-HSFLs direction by both nanocapillary waves and the localized electric field coming from the excited large Si particles.

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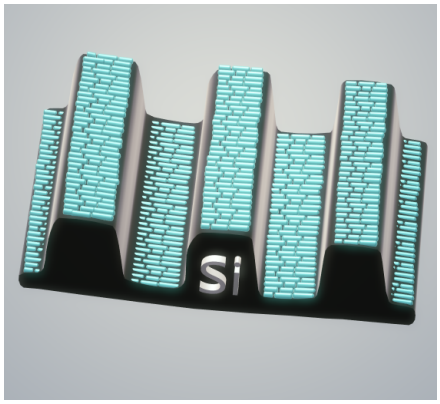

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Original Article

Optical camouflage is a magical capability of many living animals. Among many different crypsis mechanisms, polarization is a more amazing technique that was only recently revealed. Here, Prof. Xiangang Luo's group go one step further to develop an approach toward the polarimetric crypsis in the thermal infrared band, where the polarized thermal emission near the pseudo-Brewster angle is the main signal source and no existing camouflage technique has been discovered in nature. Inspired by the hydrodynamic effect of micro-structured surfaces, the electromagnetic resistance-reduction effect is proposed, which could eliminate the otherwise significant ohmic loss and thermal radiation for p-polarized light near the pseudo-Brewster angle, by virtue of a new electromagnetic boundary layer formed by an array of metallic posts. This interesting effect has been successfully exploited in broadband thermal polarimetric crypsis and polarization conversion, which would provide many new perspectives for subwavelength electromagnetics as well as biomimetics.

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