Direct femtosecond-laser projection lithography on perovskites for advanced nanophotonic applications

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Nanophotonics based on resonant nanostructures and metasurfaces made of halide perovskites have become a prospective direction for efficient light manipulation at subwavelength scale in advanced photonic designs. One of the main challenges in this field is the lack of large-scale low-cost technique for subwavelength perovskite structures fabrication preserving highly efficient luminescence. We demonstrate novel approach for 3D micropatterning of perovskite films via direct femtosecond laser projection lithography. Whereas majority of previous works used laser processing only for rough cutting/scribing of perovskite materials at microscale level, here by using advanced laser beam engineering and delicate multi-pulse processing we showed capability of flexible non-destructive 3D processing of perovskites at sub-diffraction resolution down to 250 nm [1]. Additionally, for the first time in literature, we provide valuable theoretical insight into ablation mechanism of halide-perovskite material with ultrashort laser radiation [2]. The elaborated optimized laser processing regime allowed to control 3D surface morphology preserving optoelectronic properties of the irradiated perovskite material, thus opening pathway for high-performing inexpensive and large-scale fabrication of nanostructures and surface textures suitable for advanced light-emitting, surface coloring and information encryption applications (Fig. 1).

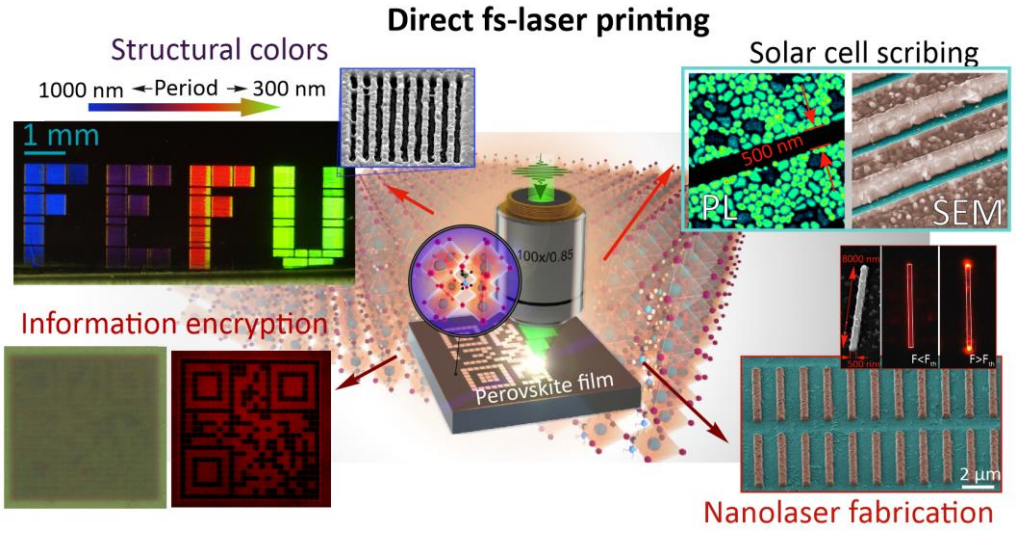

Fig.1. Scheme showing diverse applications of nanostructures made of halide perovskites via direct femtosecond laser projection lithography.

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Литература

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