Laser-induced periodic surface structures: from nanoscaled light localization to applications

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This presentation reviews the current state in the field of Laser-Induced Periodic Surface Structures (LIPSS). These surface nanostructures are a universal phenomenon and can be generated in a "self-ordered" way on almost any material by irradiation with intense linearly polarized laser radiation [1]. During the last decade, research on LIPSS is often accompanying material processing applications on diverse fields since they can be produced following a single-step process enabling surface functionalization through the adaption of optical, mechanical and chemical surface properties. The structural sizes of LIPSS typically range from several micrometers down to less than 100 nanometers exhibiting a clear correlation with the polarization direction of the laser radiation. Various types of surface structures are classified, relevant control parameters are identified, and their material specific formation mechanisms are analyzed for different types of inorganic solids, i.e., metals, semiconductors, and dielectrics, through time-resolved optical experiments [2-4] and theoretical simulations [4,5]. Finally, technological applications featuring surface functionalization in the fields of optics, fluidics, medicine, and tribology are discussed [6,7].

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