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TECHNOLOGY INFO SHEET

New lithographic method for creating complex microstructures with the capability of spectrum modification

Development status

- Proof of concept
- **Development**
- Product development and Testing
- Entering to market
- Market development

IP status

- In priority year
- PCT I.
- PCT II.
- **National/regional phase**
- Validation

Challenge

In case of short pulses, it is a complicated task to match the phases of the interfering beams. The present invention relates to a novel kind of micro structuring method. In particular, the present invention relates to a method to modify and optionally also to engineer structural spectra, i.e. mainly absorption and/or emission spectra of solid materials, especially of metals, in a controlled manner. Specifically, the subject matter of the present invention is a novel lithographic method, by means of which complex micro structures of predefined spectra can be fabricated in at least one, more preferably in at least two spatial directions within a region of relatively large physical dimension. Our studies also showed that, from the viewpoint of performing the combined lithographic method according to the invention, making use polarized light is preferred, too.

Technology

Upon experimental and theoretical considerations, it concluded that a possibility for achieving the technology is to provide a periodic intensity modulation and a near-field enhancement (that is, increase in intensity) simultaneously when microstructure formation takes place. It is highly advantageous if said periodic intensity modulation is provided in the form of an illumination that is realized by an interference pattern generated by monochromatic light. Combining interference lithography with colloid sphere lithography according to the invention, as well as carrying out the thus obtained novel type lithography method allows near-field concentration of the periodically modulated intensity distribution. In the presence of the colloid spheres, near-field enhancement appears behind the colloid spheres in accordance with the pattern determined by the symmetry and periodicity of the interference modulation but in surface regions that have a size which is

much smaller than the illumination wavelength. Since all colloid spheres illuminated with the intensity maxima of the interference pattern lead to near field enhancement, the relative (inter-object) distance of the nano-objects fabricated along directions defined by the maxima concerned will be determined by the diameter of the colloid sphere. The actual value of this distance, however, will depend on the (relative) orientation of the interference pattern with respect to the monolayer of the colloid spheres. In turn, the distance between parallel lines of the colloid spheres. In turn, the distance between parallel lines of the nano-objects fabricated can be set by a periodicity of the interference pattern, independently of said distance.

Keywords

Colloid sphere lithography, interference lithography, Complex microstructures, spectral engineering, Small (nanoscale) object manufacturing

Benefits

- Microstructures with unique spectral properties on a relatively large (~dm^2) surface area can be prepared.
- Provides controllability over all important geometrical parameters of 2D and 3D structures and thus allows modifying the absorption/emission spectrum practically in a predefined manner.
- It can be used in numerous fields of practice e.g. high density data storage or biosensor technologies.

Development status

Currently, the method is being developed and tested in laboratory environment, and researchers are working on elevating it into the product development phase.

IP status

The Hungarian Patent Application (P1100461) was submitted in 2011.

The PCT examination (PCT/HU2012/000078) was extended to the US (14/240,170) in 2014.

What we are looking for

The University of Szeged is looking for possible partners, who would further develop this invention into a prototype. The University is ready to negotiate licencing, partnering, R&D cooperation and other utilization forms.

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