



COLOR CODING THROUGH MICRO AND NANOSTRUCTURES

Task

The visible color spectrum between 400 nm and 800 nm is a section of the electromagnetic spectrum whose individual spectral components are perceived as color by the human eye. If the spectrum of a light source strikes the periodic pattern of a micro- or nanostructured surface, its spectral components are diffracted under different angles. Therefore, the surface appears in a different color depending on the angle of view. With ultrashort pulsed laser radiation, defined structures can be generated on surfaces that reflect or absorb specific parts of the color spectrum. This project aims to generate a predefined colored pattern through an automated microstructuring process on different materials.

Method

»Laser interference structuring« or direct structuring with ultrashort pulsed laser radiation can be used to generate deterministic and self-organized statistical structures on different materials. Deterministic interference structures are generated by the superposition of two partial beams on the surface of the material. The intensity profile on the surface allows a linear structuring on the material surface. By using ultrashort pulsed laser radiation, the institute can process and thus structure metals, plastics or semiconductor materials. Statistical, self-organizing structures result from an electro-magnetic

excitation of the surface by the laser pulse. Depending on wavelength and material, structure sizes from 500 nm to 5 µm can be generated. In addition to the optical properties, surface properties such as haptics or adhesion by the surface structures can be selectively influenced.

Results

The interference structures with a sinusoidal topography can be structured with surface rates of up to 60 cm²/min. The laser, the optical system and the sample movement are synchronized so that, section by section, different structure patterns can be generated. Here, every single pattern appears under a defined viewing angle as matt grey or a defined color. In this manner, any color images can be generated depending on the arrangement of the different structural sections.

Applications

In contrast to color pigments, microstructures do not fade, thus resulting in a long-term stable color effect. In addition to decorative applications, the structures can be used for the production of technical surfaces in the medical, biotechnological field or security marking in production.

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1 Color effects generated by interference structuring.

2 Microstructured metal surface.