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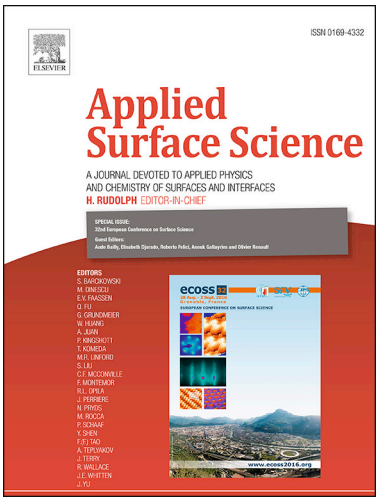

Full Length Article

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In-volume structuring of a bilayered polymer foil using direct laser interference patterning

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Keywords: laser material processing, microstructure fabrication, direct laser interference patterning, in-volume structuring, decorative element, functionalization

Abstract:

Periodic surface patterns can provide materials with special optical properties, which are usable in decorative or security applications. However, they can be sensitive to contact wear and thus their lifetime and functionality are limited. This study describes the use of direct laser interference patterning for structuring a multilayered polymer film at its interface creating periodic in-volume structures which are resistant to contact wear. The spatial period of the structures are varied in the range of 1.0 µm to 2.0 µm in order to produce decorative elements. The pattern formation at the interface is explained using cross sectional observations and a thermal simulation of the temperature evolution during the laser treatment at the interface. Both, the diffraction efficiency and direct transmission are characterized by light intensity measurements to describe the optical behavior of the produced periodic structures and a decorative application example is presented.

1. Introduction

Periodical structures in surfaces with feature sizes in nano- and micrometer range have shown benefits in the optical behavior of the materials for example an increase of the efficiency in solar cells, usage as diffraction grating or as decorative and security elements [1–13]. However, in several cases these surfaces are sensitive to contact wear and they can be easily damaged [14–17]. Also fingerprints and other contact pollutions can influence the functionality negatively.