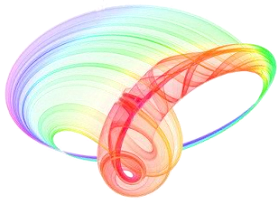
Book of abstracts



PHOTONICA2021

VIII International School and Conference on Photonics

& HEMMAGINERO workshop

23 - 27 August 2021,

Belgrade, Serbia

Editors

Mihailo Rabasović, Marina Lekić and Aleksandar Krmpot

Institute of Physics Belgrade, Serbia

Belgrade, 2021

ABSTRACTS OF TUTORIAL, KEYNOTE, INVITED LECTURES, PROGRESS REPORTS AND CONTRIBUTED PAPERS

of

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Publisher
Institute of Physics Belgrade
Pregrevica 118
11080 Belgrade, Serbia

Printed by
Serbian Academy of Sciences and Arts

Number of copies
200

ISBN 978-86-82441-53-3

CIP - Каталогизација у публикацији - Народна библиотека Србије, Београд

535(048)

621.37/.39:535(048)

621.37/.39:535]:61(048)

66.017/.018(048)

INTERNATIONAL School and Conference on Photonic (8; 2021; Beograd)

Book of abstracts / VIII International School and Conference on Photonics PHOTONICA2021 & HEMMAGINERO workshop, 23 - 27 August 2021, Belgrade, Serbia; editors Mihailo Rabasović, Marina Lekić and Aleksandar Krmpot. - Belgrade: Institute of Physics, 2021 (Belgrade: SASA). - V, 192 str.: ilustr.; 30 cm

Tiraž 200. - Bibliografija uz većinu apstrakata. - Registar.

ISBN 978-86-82441-53-3

1. Hemmaginero Workshop (2021; Beograd)

а) Оптика -- Апстракти б) Оптички материјали -- Апстракти в) Оптоелектроника -- Апстракти г) Оптоелектроника -- Биомедицина -- Апстракти д) Телекомуникације -- Апстракти

COBISS.SR-ID 44290057

The surface array structures induced by femtosecond laser modifications of Ti/Cr multilayer thin films for biomedical applications

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The experimental study of the static and dynamic femtosecond laser ablation of the multilayer 15x(Ti/Cr)/Si system is reported. The layer-by-layer selective laser ablation mechanism was studied by analysis of the surface morphology and elemental composition in static single pulse irradiation in a range of pulse energy from 10 – 17 μJ. The selective ablations as number of concentric circles in modified spots are increased with the pulse energy. The boundary between the circles was shown a change in the depth, comparable to the thickness of the individual layers. Changes in the elemental composition at the edges are associated with the removal of the layer by layer. Due to the intermixing of components and higher content of oxygen in the central area of ablated spots, it is expected that an ultra-thin layer composed of Ti and Cr oxide phases is formed at the bottom of the ablated center. The dynamic multi-pulse irradiation was observed via the production of lines with laser-induced periodic surface structures (LIPSS) at different laser parameters (scan velocities and laser polarization). The spatial periodicity of the formed LIPSS depends on changes in the effective number of pulses and laser polarization, as well as the nature of the material. The formation of LIPSS is followed with the significant ablation of multilayer 15x(Ti/Cr)/Si system, without visible hydrodynamic features, but ripples are somewhere covered with nanoparticles dimension up to 100 nm.

The main focus of this experimental study was examined a novel Ti/Cr nanolayered composite in order to create a biomimetic surface with suitable composition and structure for cell integration. Using SEM and confocal microscopy images of the laser modified surfaces with seeded cell culture (NIH 3T3 fibroblasts) was found that cell adhesion and their growth depend on the surface composition and morphological forms. These results indicated a good adhesion and proliferation of cells after two and four days, with some tendency of grouping of cells on the laser modified surfaces.

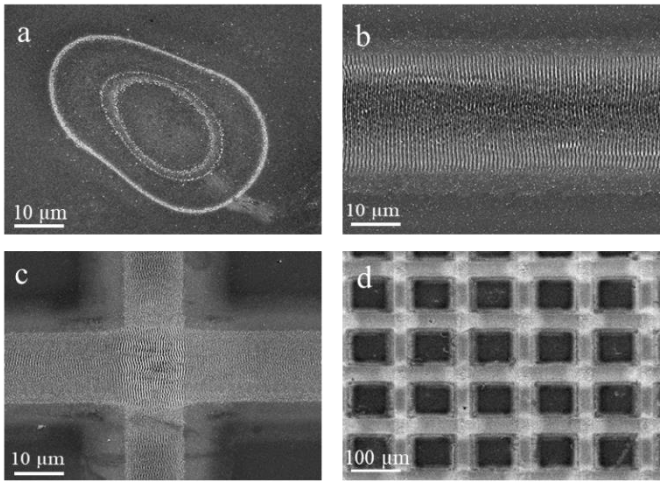

Figure 1. SEM images of 15x(Ti/Cr)/Si multilayer thin film after fs modification at the pulse energy of 15 μJ for the created: (a) spot, (b) lines, (c) crossed lines and (d) network-like structure on a larger surface.