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 Influence of Ion Implantation of Iron on the Surface Properties of High Density Polyethylene

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In this study, iron-polyethylene nanocomposites were synthesized, by ion implantation with different fluences, in the range from 5×10^{16} ions/cm^2 to 5×10^{17} ions/cm^2, and at the energy of 95 keV. Rutherford backscattering spectroscopy confirmed the presence of iron in the implanted samples, and the calculated fluences matched with those predicted, except for the highest implantation fluence, where a significant difference was due to the sputtering effect. It was also found that the depth of damage was slightly lower than predicted by the SRIM simulation [1]. X-ray photoelectron spectroscopy has revealed that implanted iron is in the form of pure metallic iron - Fe (0), and multiple iron oxides. On the other hand, carbon was mostly transformed from a sp^3 hybridized, to a sp^2 hybridized, indicating that the carbonization of polyethylene and the degassing of hydrogen took place. Infrared spectroscopy has indicated that aldehydes and ketones are formed after implantation, and that many organic compounds are likely to form upon implantation with the highest fluence. Atomic force microscopy confirmed that implantation led to considerable destruction of the surface, resulting in changes of surface morphology, and a considerable increase of surface roughness [2]. Transmission electron microscopy microphotographs show that after implantation, iron nanoparticles are formed, and the particle sizes have a characteristic depth distribution, according to which they can be classified into three zones. However, a continuous layer is formed in the case of the highest implantation fluence. Energy dispersive spectrophotometric analysis of a single particle indicated that the nanoparticle interior was mainly composed of pure metallic iron, and that the iron oxides probably dominated near the very surface of the nanoparticles [1]. From the measurements of the sheet resistivity by the 4-point contact probe method, it was observed that between the 1×10^{17} ions/cm^2 and 2×10^{17} ions/cm^2 fluences, a transition occurs in which the metal phase takes a dominant role in the mechanism of electric conduction and that percolation most likely is achieved for fluences in the range between 2×10^{17} ions/cm^2 and 5×10^{17} ions/cm^2 [2]. Measurements by Kerr magneto-optical magnetometry have indicated that the magnetic properties change in accordance with the applied implantation fluence and the morphology of the iron nanoparticles formed in the surface layer. The occurrence of the ferromagnetic phase can be observed for the two higher fluences, with a coercivity of only 20 Oe for the fluence of 2×10^{17} ions/cm^2, whereas for the highest fluence of 5×10^{17} ions/cm^2, the coercivity is 57 Oe. The shape of hysteresis loop is typical of a mixture of single and multi-domain particles. UV-VIS spectroscopy showed that, as a consequence of implantation, the peaks in the Kubelka - Munk spectra of remission function appear [1], most likely originating from localized surface plasmon resonance of the iron nanoparticles [3,4]. Surface energy changes with the implantation fluence, in a way that it increases up to a fluence of 1×10^{17} ions/cm^2, and then decreases with increasing fluence. It was also found that the hydrophobic, i.e. dispersive character of the surface does not change significantly as a consequence of implantation [2].

REFERENCES

[1] D. Kisić, M. Nenadović, J. Potočnik, M. Novaković, P. Noga, D. Vaňa, A. Závacká, Z. Rakočević, Vacuum 171, 109016 (2020)
[2] D. Kisić, M. Nenadović, T. Barudžija, P. Noga, D. Vaňa, M. Muška, Z. Rakočević, Nucl. Instrum. Methods Phys. Res. B 462, 143 (2020)
[3] U. Kreibig, M. Vollmer, Optical Properties of Metal Clusters, Springer, Verlag, Berlin, Heidelberg, (1995)
[4] F. Mashayekhi, A. Shafiekhani, S.A. Sebt, Eur. Phys. J. Appl. Phys. 74, 30402 (2016)