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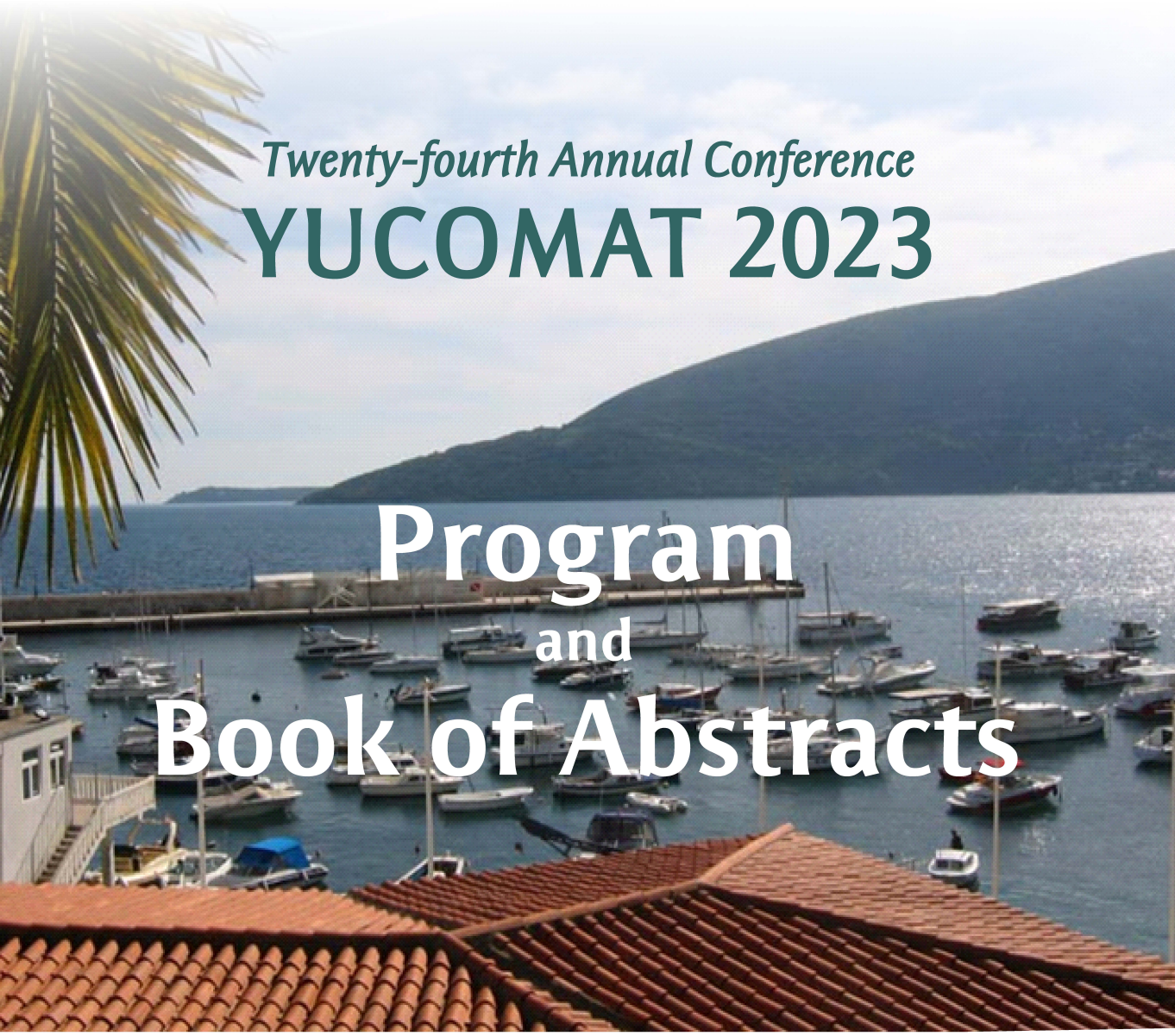

Twenty-fourth Annual Conference

YUCOMAT 2023

Program and Book of Abstracts

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FEDERATION OF EUROPEAN MATERIALS SOCIETIES

Materials Research Society of Serbia

24 conference

SERBIA MRS

YUCOMAT 2023

Herceg Novi, Montenegro :: September 4-8, 2023

TWENTY-FOURTH ANNUAL CONFERENCE

YUCOMAT 2023

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P.S.21.

The effect of swift heavy ion irradiation on physicochemical properties of monoclinic bismuth vanadate

Marko Jelić[1], Ekaterina Korneeva[2], Nikita Kirilkin[2], Tatiana Vershinina[2], Oleg Orelovich[2], Vladimir Skuratov[2], Zoran Jovanović[1], Sonja Jovanović[1]

[1]Vinča Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia, [2]Joint Institute for Nuclear Research, Dubna, Russia

Monoclinic bismuth vanadate ($BiVO_4$) is considered to be one of the most promising photoanode materials for photoelectrochemical (PEC) water splitting due to its suitable band gap and band structure, good stability and low-cost synthesis. However, $BiVO_4$ has poor charge transfer properties due to the high rate of electron-hole recombination and understanding the effects contributing to it is important for further improvements. Herein, we report the effect of swift heavy ion irradiation (Xe, 150 MeV, 10^{10} – 5×10^{11} ions/cm^2) on physicochemical properties of hydrothermally synthesized $BiVO_4$ thin films. X-ray diffraction study (XRD) showed that irradiated material preserved initial monoclinic scheelite crystal phase and preferential growth along [010] direction. As the fluence increased, a shift of the diffraction maxima towards lower 2θ values was observed indicating increased interplanar distances. Also, for the 5×10^{11} ions/cm^2 irradiated sample, high degree of amorphization was noticed. Scanning electron microscopy (SEM) of all samples showed prismatic grains with an average size of 600 nm. In irradiated samples formation of ion tracks, ~10 nm in diameter, was observed. X-ray photoelectron spectroscopy (XPS) analysis of Bi 4f, V 2p and O 1s states showed that, after irradiation, increased amounts of V^{4+} and oxygen in the form of hydroxide occurred, especially at higher fluences. By using UV-Vis Diffuse Reflectance spectroscopy we showed that band gap decreased with the increase of fluence. Photocurrent densities obtained from linear sweep voltammetry indicated that irradiation with fluences higher than 10^{10} ions/cm^2 have a notable negative effect on PEC oxygen evolution reaction. However, 1-hour-long chronoamperometry measurements of 10^{10} ions/cm^2 irradiated sample revealed an increase of photocurrent densities. In order to get a better insight into preceding phenomena, we performed XRD, SEM and XPS analysis after PEC process.