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Twenty-third Annual Conference

YUCOMAT 2022

&

Twelfth World Round Table Conference on Sintering

XII WRTCS

Program

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FEDERATION OF EUROPEAN MATERIALS SOCIETIES

12th World Round Table Conference on Sintering

WRTCS 2022

International Institute for the Science of Sintering

TWENTY-THIRD ANNUAL CONFERENCE

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Hunguest Hotel Sun Resort, Herceg Novi, Montenegro
August 29 - September 2, 2022

Program
and
the Book of Abstracts

Organised by:
Materials Research Society of Serbia
&
International Institute for the Science of Sintering

Endorsed by:
Federation of European Material Societies

CIP - Каталогизацијаупубликацији
НародналбиблиотекаСрбије, Београд

66.017/.018(048)
621.762.5(048)

DRUŠTVO za istraživanje materijala Srbije (Beograd). Godišnja konferencija (23 ; 2022 ; Herceg Novi)
Program ; and The Book of abstracts / Twenty-third Annual Conference YUCOMAT 2022 & Twelfth World Round Table Conference on Sintering XII WRTCS 2022, Herceg Novi, Montenegro, August 29 - September 2, 2022 ; organised by Materials Research Society of Serbia & International Institute for the Science of Sintering ; [editor Dragan P. Uskoković]. - Belgrade : Materials Research Society of Serbia, 2022 (Herceg Novi : Biro Konto). - XLV, 185 str. : ilustr. ; 23 cm

Tiraž 200. - Bibliografija uz pojedine apstrakte. - Registar.

ISBN 978-86-919111-7-1

1. World Round Table Conference on Sintering (12 ; 2022 ; Herceg Novi) a) Наука о материјалима -- Апстракти б) Технички материјали -- Апстракти в) Синтеровање -- Апстракти

COBISS.SR-ID 71996169

Title: TWENTY-THIRD ANNUAL CONFERENCE **YUCOMAT 2022** &
TWELFTH WORLD ROUND TABLE CONFERENCE ON SINTERING **XII WRTCS**
Program and the Book of Abstracts

Publisher: Materials Research Society of Serbia
Knez Mihailova 35/IV, P.O. Box 433, 11000 Belgrade, Serbia
Phone: +381 11 2185-437; http://www.mrs-serbia.org.rs

Editor: Prof. Dr. Dragan P. Uskoković

Technical editor: Ivana Kovačević

Typesetting & prepress: Dr. Aleksandar Dekanski
Cover page: Nenad Ignjatović
Covers: Images on front & back covers are the property of MRS-Serbia

ISBN-978-86-919111-7-1

MRS Serbia is member of the
Federation of European Materials Societies

Printed in: Biro Konto
Sutorina bb, Igalo – Herceg Novi, Montenegro
Phones: +382-31-670123, 670025, E-mail: bkonto@t-com.me
Circulation: 200 copies. The end of printing: August 2022

P.S.I.A.3.

Supercritical CO_2 assisted deposition of $MAPbBr_3$ perovskite onto TiO_2 nanotubes

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Supercritical carbon dioxide (sCO_2) is an ideal low-temperature cosolvent for perovskite deposition due to its relatively low critical point (31.2 °C, 73.8 bar), no surface tension, liquid-like density, gas-like viscosity, and diffusivity. It enables faster mass transfer which allows penetration of crystals in nanoporous structure. The study investigates the influence of time of deposition of perovskite assisted with supercritical carbon dioxide on the filling of nanotubes. Perovskite solar cell technology has been developed so fast due to several factors including a tunable band gap, high absorption coefficient, and low-cost fabrication. The quality of the perovskite film is important for the high efficiency of perovskite solar cells. Perovskite precursors are usually deposited from the solution onto a substrate using spin-coating followed by post-deposition treatments, but often it results in low-quality films that cannot provide good photovoltaic performances. Deposition of perovskite in the presence of sCO_2 is a promising method for the formation of high-quality perovskite layers. In this work, methylammonium lead bromide perovskite ($MAPbBr_3$) was deposited on TiO_2 nanotubes from the solution in dimethylformamide (DMF) by application of sCO_2 at 35 °C and 200 bar for 1 h, and 3 h. FESEM results show that TiO_2 nanotubes were filled with perovskite material in both cases. The diffuse reflectance spectroscopy measurement of samples proved that the absorption edge of prepared TiO_2 nanotubes/$MAPbBr_3$ was extended to the visible range. Measurement of I-V characteristics showed that the sample made for 3 h had a higher value of current than the sample prepared for 1 h. The application of sCO_2 during the deposition of perovskite has enabled the preparation of a photodiode with a better contact between TiO_2 nanotubes and perovskite which is important for the future development of solar cells.