

Proceedings of the

Advanced Architectures in Photonics

September 21–24, 2014

Prague, Czech Republic

Volume 1

Editors

Jiri Orava

University of Cambridge
Department of Materials Science and Metallurgy
27 Charles Babbage Road
CB3 0FS Cambridge
United Kingdom

Tohoku University
WPI-Advanced Institute for Materials Research
(WPI-AIMR)
2-1-1 Katahira, Aoba-ku
980-8577 Sendai
Japan

Tomas Kohoutek

Involved Ltd.
Siroka 1
537 01 Chrudim
Czech Republic

Proceeding of the Advanced Architectures in Photonics
<http://aap-conference.com/aap-proceedings>

ISSN: 2336-6036
September 2014

Published by **Involved Ltd.**
Address: Siroka 1, 53701, Chrudim, Czech Republic
Email: info@involved.cz, Tel. +420 732 974 096



This work is licensed under a
[Creative Commons Attribution
3.0 Unported License](https://creativecommons.org/licenses/by/3.0/).

CONTENTS

[Preface](#)

T. Wagner (Chairman)	i
----------------------------	---

FULL PAPERS

[Innovative nanoimprint lithography](#)

S. Matsui, H. Hiroshima, Y. Hirai and M. Nakagawa	1
---	---

[Nanofabrication by imprint lithography and its application to photonic devices](#)

Y. Sugimoto, B. Choi, M. Iwanaga, N. Ikeda, H. T. Miyazaki and K. Sakoda	5
--	---

[Soft-mould imprinting of chalcogenide glasses](#)

T. Kohoutek, J. Orava and H. Fudouzi	9
--	---

[Electric nanoimprint to oxide glass containing alkali metal ions](#)

T. Misawa, N. Ikutame, H. Kaiju and J. Nishii	11
---	----

[Producing coloured materials with amorphous arrays of black and white colloidal particles](#)

Y. Takeoka, S. Yoshioka, A. Takano, S. Arai, N. Khanin, H. Nishihara, M. Teshima, Y. Ohtsuka and T. Seki	13
--	----

[Stimuli-responsive colloidal crystal films](#)

C. G. Schafer, S. Heidt, D. Scheid and M. Gallei	15
--	----

[Opal photonic crystal films as smart materials for sensing applications](#)

H. Fudouzi and T. Sawada	19
--------------------------------	----

[Introduction of new laboratory device 4SPIN® for nanotechnologies](#)

M. Pokorny, J. Rebíček, J. Klémes and V. Velebný	20
--	----

[Controlling the morphology of ZnO nanostructures grown by Au-catalyzed chemical vapor deposition and chemical bath deposition methods](#)

K. Govatsi and S. N. Yannopoulos	22
--	----

[Visible photon up-conversion in glassy \(Ge₂₅Ga₅Sb₅S₆₅\)_{100-x}Er_x chalcogenides](#)

L. Strizik, J. Zhang, T. Wagner, J. Oswald, C. Liu and J. Heo	27
---	----

POSTERS presented at AAP 2014

[Solution processing of As-S chalcogenide glasses](#)

T. Kohoutek	31
-------------------	----

[Ga-Ge-Sb-S:Er³⁺ amorphous chalcogenides: Photoluminescence and photon up-conversion](#)

L. Strizik, J. Oswald, T. Wagner, J. Zhang, B. M. Walsh and J. Heo	32
--	----

[Multi-wavelength and multi-intensity illumination of the GeSbS virgin film](#)

P. Knotek, M. Kincl and L. Tichý	33
--	----

[Towards functional advanced materials based using filling or ordered anodic oxides supports and templates](#)

J. M. Macak, T. Kohoutek, J. Kolar and T. Wagner	34
--	----

[Introduction of new laboratory device 4SPIN® for nanotechnologies](#)

M. Pokorny, J. Rebíček, J. Klémes and V. Velebný	35
--	----

[Profile and material characterization of sine-like surface relief Ni gratings by spectroscopic ellipsometry](#)

J. Mistrik, R. Antos, M. Karlovec, K. Palka, Mir. Vlcek and Mil. Vlcek	36
--	----

[Preparation of sparse periodic plasmonic arrays by multiple-beam interference lithography](#)

M. Vala and J. Homola	37
-----------------------------	----

[High-performance biosensing on random arrays of gold nanoparticles](#)

B. Spackova, H. Sipova, N. S. Lynn, P. Lebruskova, M. Vala, J. Slaby and J. Homola	38
--	----

Multi-wavelength and multi-intensity illumination of the GeSbS virgin film

Knotek P. ¹, Kincl M. ^{1,2} and Tichý L. ^{1,2}

¹ Joint Laboratory of Solid State Chemistry, Faculty of Chemical Technology, University of Pardubice (CZ)

² Institute of Macromolecular Chemistry, Academy of Sciences of Czech Republic, v.v.i., Heyrovského sq. 2, 162 06 Prague (CZ)

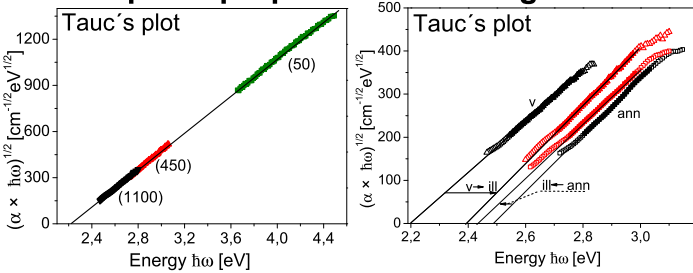
Advanced Architectures in Photonics

Prague, 21st – 24th September 2014

Introduction and aims

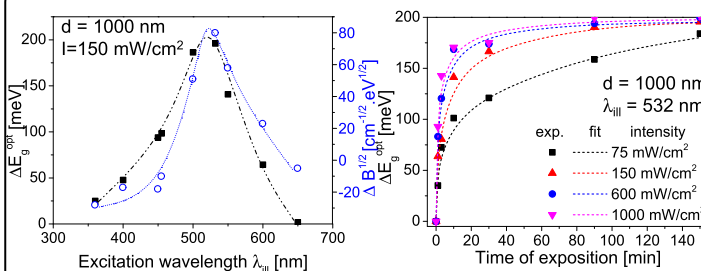
- Amorphous chalcogenides - perspective materials for optical memories, optical elements and data storage media for their unique behavior as high refractive index, high refractive nonlinearity, IR transparency and high intensity photo-induced effects
 - Amorphous $\text{Ge}_{24.9}\text{Sb}_{11.6}\text{S}_{63.5}$ film was prepared through thermal evaporation
- It was examined (i) the role of the wavelength and intensity of the excitation light on photo-bleaching, (ii) the role of the thickness on photo-bleaching of the virgin film and (iii) the possibility of high intensity UV illumination.

Optical properties of the virgin film

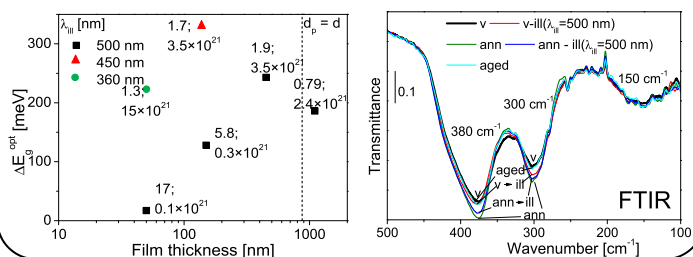


- The spectral dependence of the absorption coefficient for the virgin films for a thickness in a range $50 < d$ (nm) < 1100 independent of the film thickness.
- Typical changes in SWAE induced by the illumination and annealing. The changes of the parameters E_g^{opt} and $B^{1/2}$ exceed 9 % with respect to the virgin state.

Mild illumination condition $I = 150 \text{ mW/cm}^2$



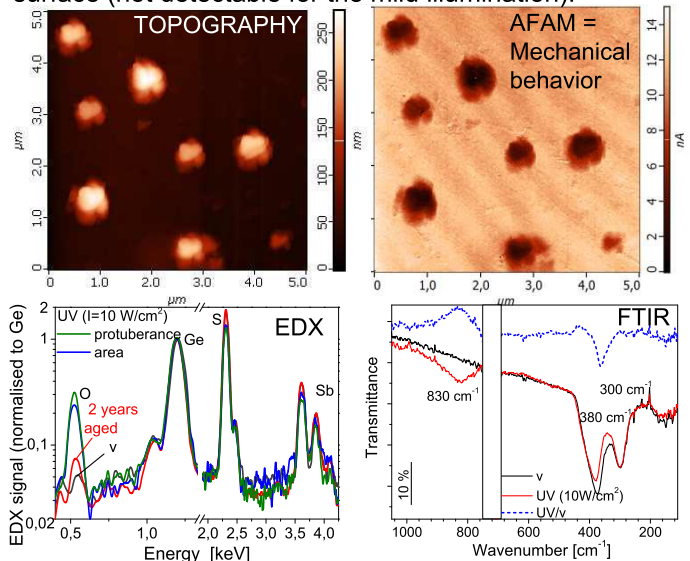
- The magnitude of the photo-bleaching (ΔE_g^{opt}) induced by monochromatic light is strongly spectral dependent.
- The maximal ΔE_g^{opt} values were obtained for the photons with the energy slightly-over the optical band gap $E_g^{\text{opt}} = 2.2\text{eV} \leftrightarrow \lambda = 560 \text{ nm}$.
- The overall kinetics were dependent on the photon intensity. The saturated state was similar for all the intensities but the rate is dependent on the intensity.
- Spectral sensitivity was only apparent. If the thin film with a thickness corresponding to the penetration depth of the over-band-gap photons was used (film with $d = 50 \text{ nm}$ illuminated by photons $\lambda_{\text{ill}} = 360 \text{ nm}$ ($E_{\text{ph}} = 3.44 \text{ eV}$)), the blue shift of the band gap was observed 220 meV.
- The origin is connected with structural changes (FTIR).



High-intensity UV illumination $I > 10 \text{ W/cm}^2$

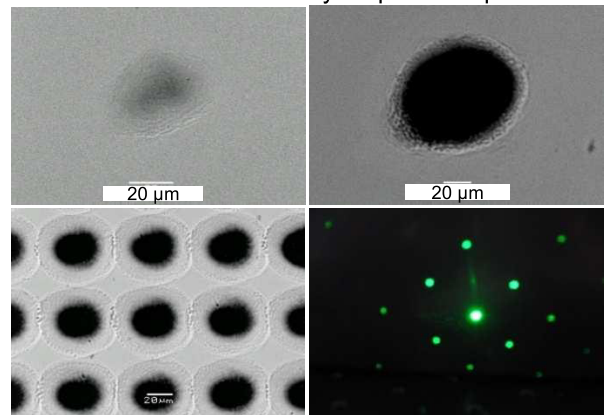
$\lambda_{\text{ill}} = 310 \text{ and } 360 \text{ nm}, I = 10 \text{ W/cm}^2$

- Intensive photo-bleaching connected with formation of protuberances/crystals and massive oxidation of the surface (not detectable for the mild illumination).



213 nm 6 ns laser (CETAC, USA) – fluency 12.9 J/cm^2

- Illumination led to the ablation and crater formation. Higher cumulative E (pulses or fluency) \leftrightarrow higher ablated volume.
- Good reproducibility ($< 5\%$ in depth and volume) enable formation of the micro-lens array for passive optical elements.



Conclusion:

- Photo-bleaching of the virgin film, induced by over-band-gap photons is only apparently spectral sensitive.
- The magnitude of photo-bleaching induced by over-band-gap photons primarily depends on the light intensity and penetration depth of the light.
- Illumination of the film with a high intensity UV light in the air leads to significant photo-oxidation or even ablation of the film.

Acknowledgement:

The authors acknowledges for the financial support from the GACR project P108/12/P044.