University of Zagreb
Faculty of Graphic Arts

International Circle of Educational Institutes for Graphic Arts: Technology and Management
46th Annual International Conference
on Graphic Arts and Media Technology, Management and Education
25-29 May 2014, Athens and Corinthia, Greece
http://www.ic2014athensgreece.gr

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APPLICATION OF FTIR IN STRUCTURAL ANALYSIS OF FLEXOGRAPHIC PRINTING PLATE

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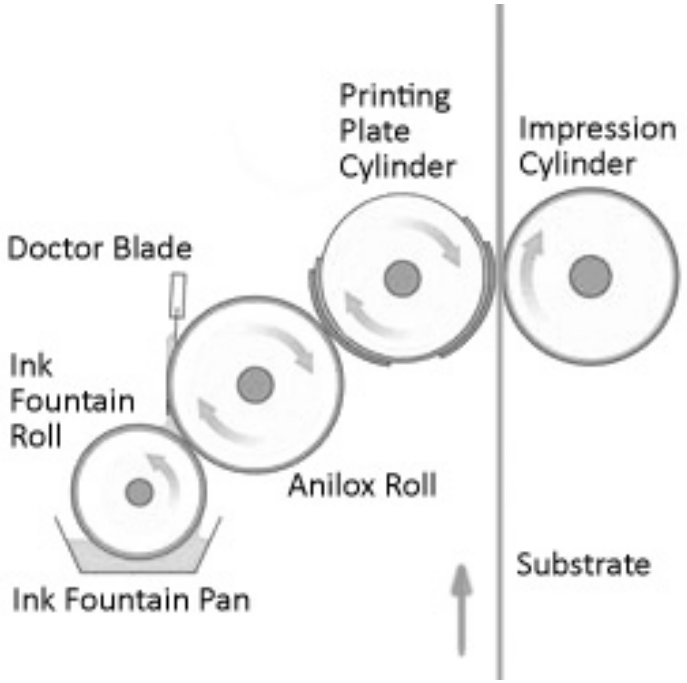
- Flexographic printing technique
- Flexographic printing plates
- Post-treatment of printing plates
- Quality control in flexography
- Experimental
- Results and discussion
- Conclusion

Flexographic printing technique

- Direct printing technique
- Packaging industry
- Printing on a wide range of substrates
- Printing plates based on photosensitive monomers
- Computer to Flex – plate-making procedure



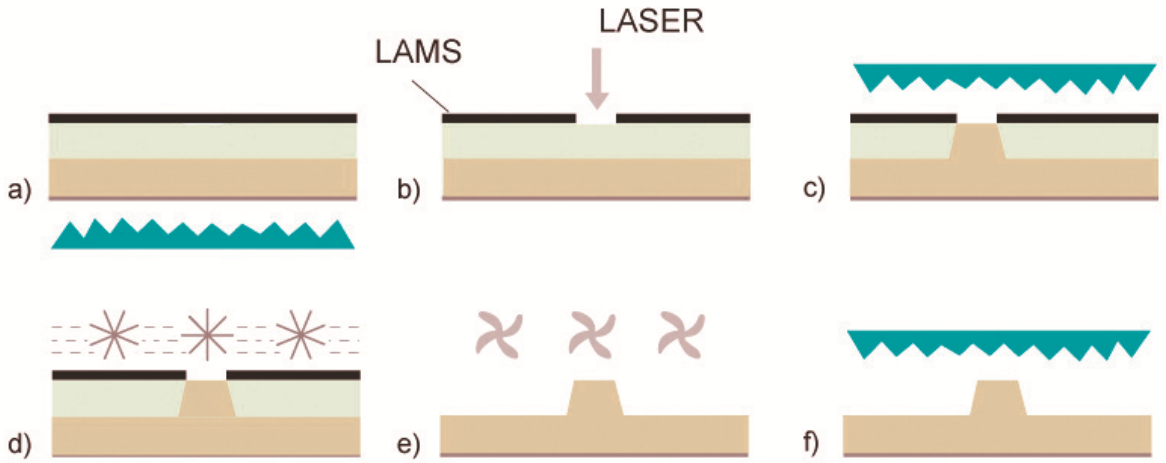
Flexographic printing plates

- Flexibility of the plate: advantage and weakness
  - Printing on a wide range of materials,
  - Possibility of deformation of printing elements because of the straining on plate cylinder and pressure in printing process

- A number of parameters which should be controlled, standardized and defined in the reproduction workflow

o LAMS technology

a) Back exposure
b) LAMS ablation
c) Main exposure
d) Chemical and mechanical developing
e) Drying/stabilization
f) Post-treatment (UVA and UVC)



Post-treatment of printing plates

- UVA post-treatment is performed in order to finish the photopolymerization process after the developing and drying/stabilization

- UVC post-treatment has been commonly performed after the UVA post-treatment in order to terminate the photopolymerization process

Quality control in flexography

- Flexography printing process depends on a number of parameters which should be controlled and defined in the reproduction workflow:
  - Properties of the printing plate, printing substrate and printing ink,
  - Quality of the file adjustment,
  - Type of the anilox roller,
  - Developing process,
  - ...

- Existing standards for flexography are mainly focused on the process control of screen ruling and reproduction of colours, printing substrates and dot gain

The aim of the paper

- **The aim of this paper was to characterize the changes in chemical structure of the flexographic printing plate by means of FTIR spectroscopy**

Experimental

- Solvent-washable, SBS copolymer LAMS-based printing plates with thickness of 1,14 mm were used

- Standard conditions of the printing plate production
  - Back and main exposure
  - Developing process
  - Stabilization period

- The parameters which were varied in this paper were duration of the UVA and UVC post-treatments (1 – 20 min)

- On the printing plate samples, surface free energy was calculated by means of a goniometer, Data Physics OCA 30

- Surface free energy of the samples was calculated based on the average value of the measured contact angles by using the OWRK method

Liquid	Surface free energy γ (mNm^{-1})		
	γ_{lv}	γ^{d}_{lv}	γ^{p}_{lv}
Diiodomethane (Ström et al.)	50.8	50.8	0.0
Glycerol (van Oss et al.)	64.0	34.0	30.0
Water (Ström et al.)	72.8	21.8	51.0

Surface free energy (γ_{lv}) and their dispersive (γ_{dlv}) and polar (γ_{plv}) components for probe liquids

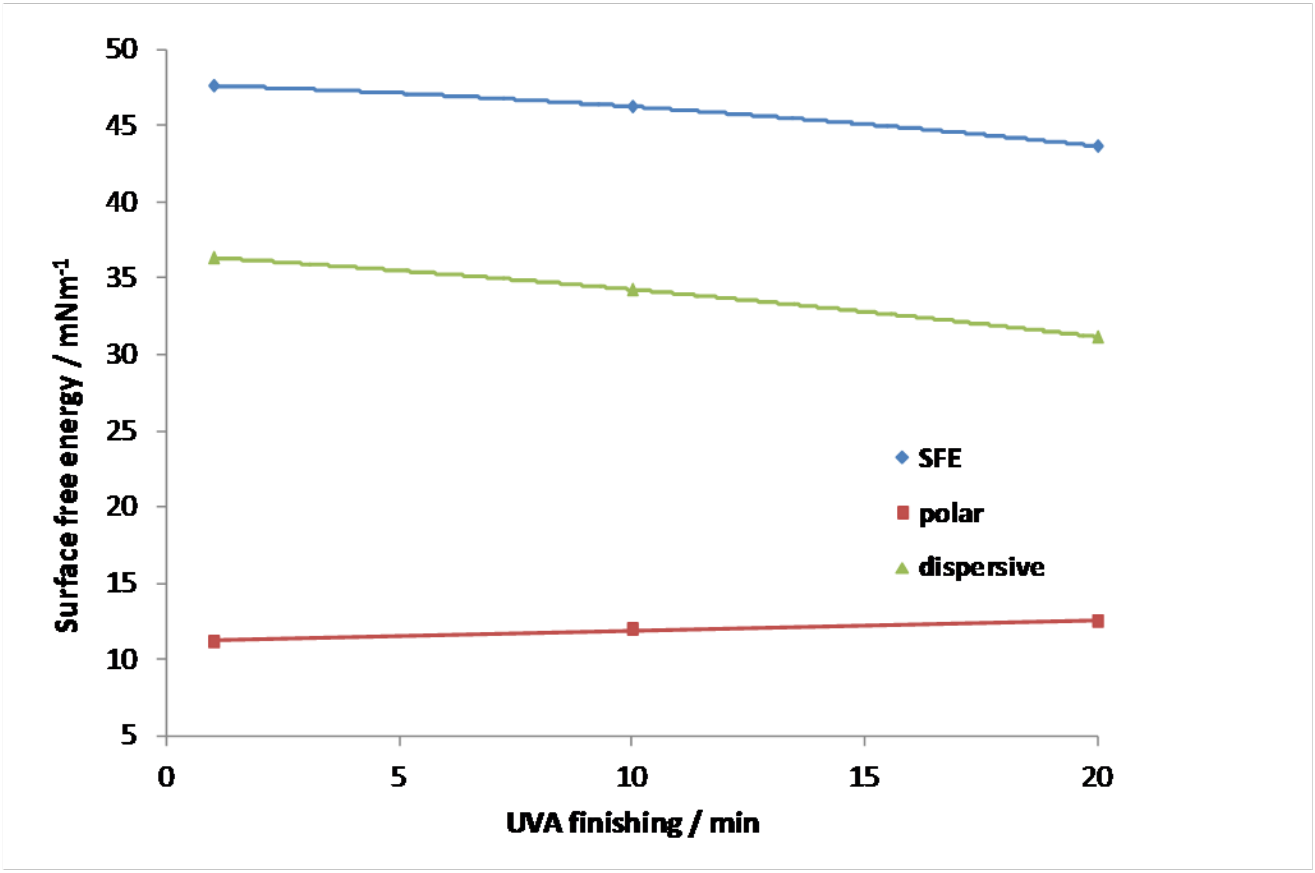
- In order to define the changes in surface structure of the photopolymer material FTIR (*Fourier transform infrared spectroscopy*) was used

- Vibrations and rotations at a certain wavelength in the IR area are detected by IR spectrometry and can help in determining molecular composition and impurities in the sample

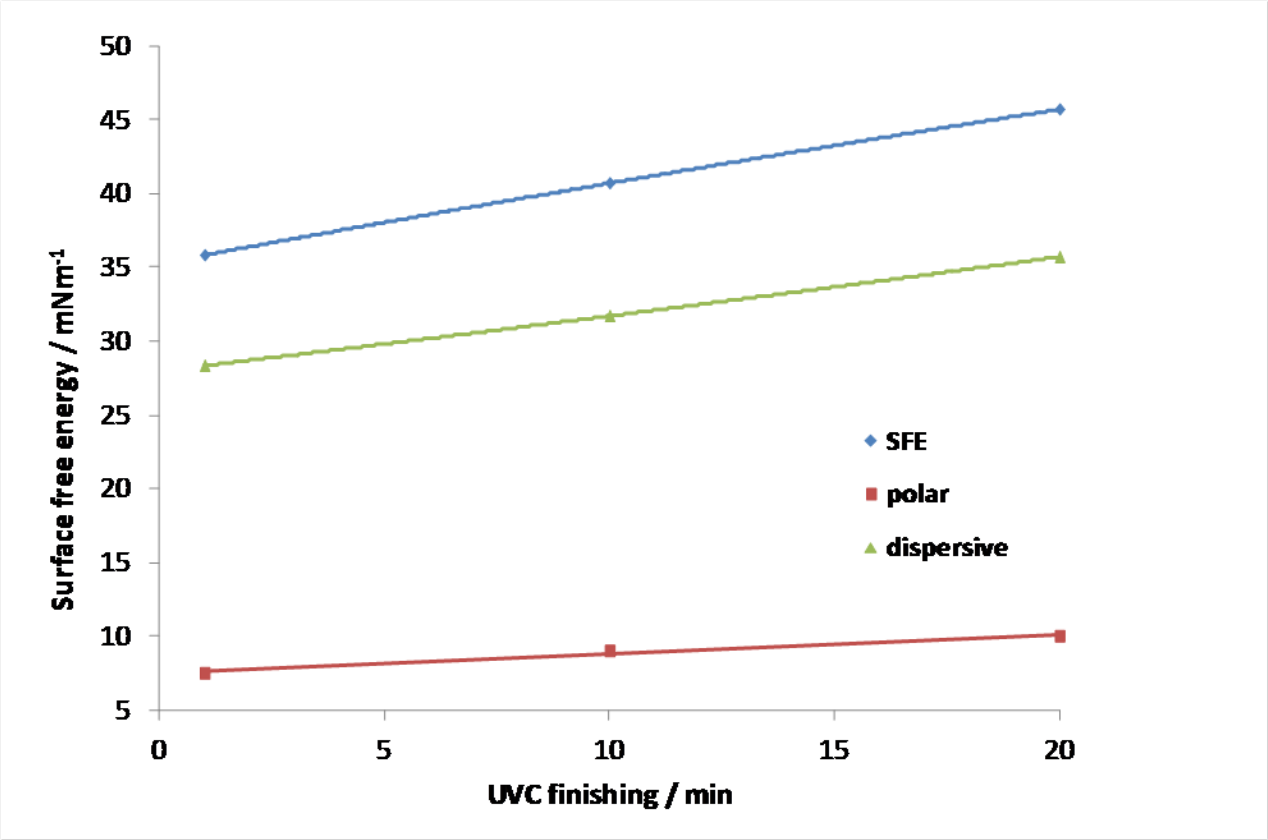
- In this paper FTIR was used for analysis of the variation in chemical structure of photopolymer material which can happen during the post-treatment platemaking phase

Results and discussion

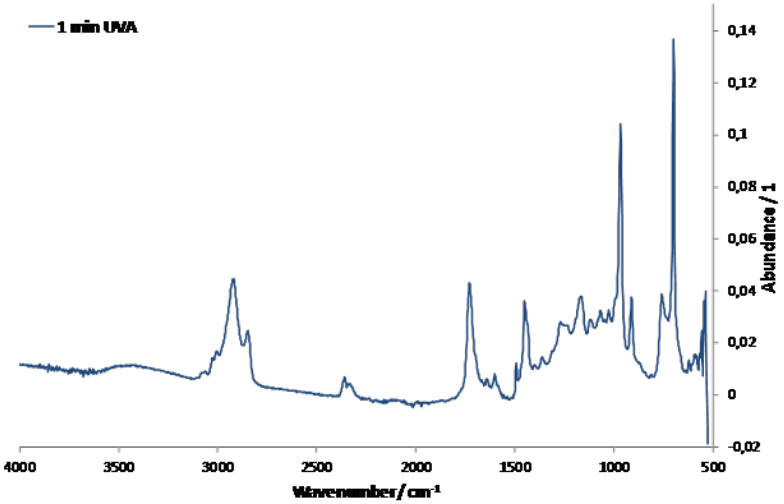
- Changes in surface free energy of the photopolymer with variations in UVA post-treatment

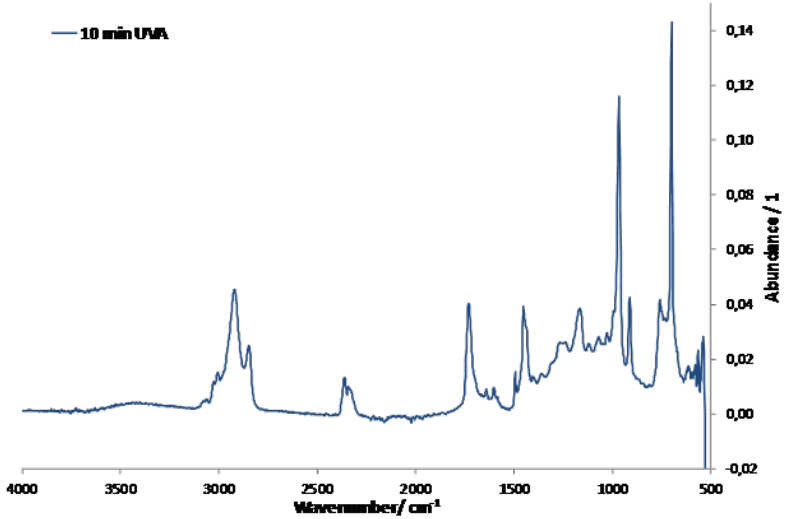


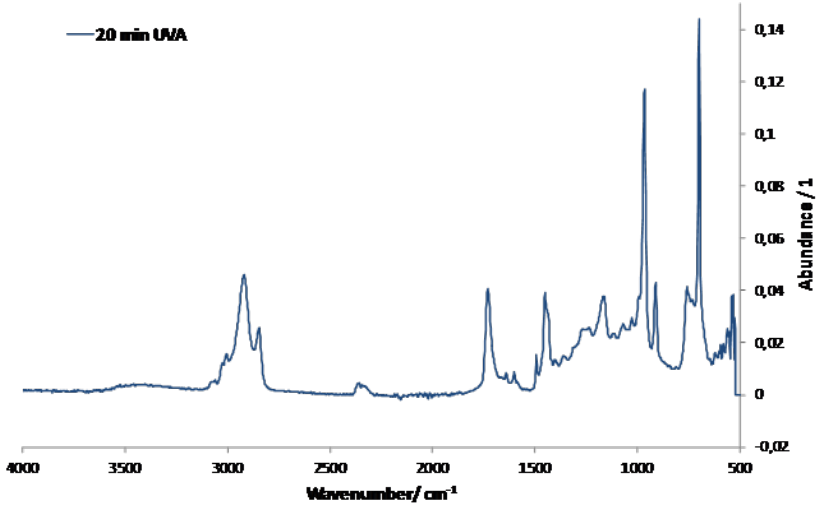
- Changes in surface free energy of the photopolymer with variations in UVC post-treatment



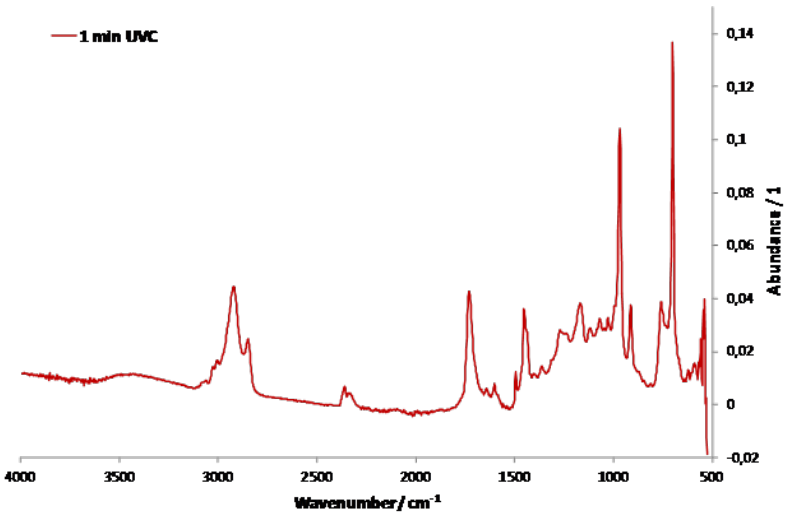
- FTIR spectra of photopolymer with different UVA post-treatment

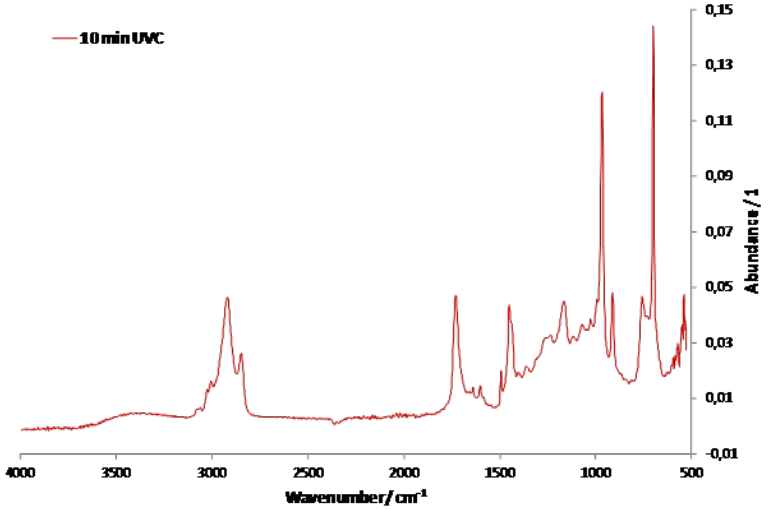


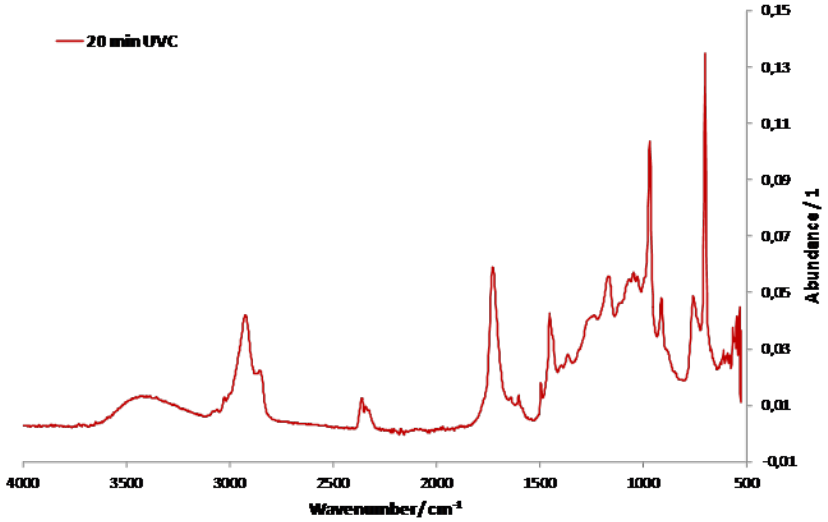




- FTIR spectra of photopolymer with different UVC post-treatment







Conclusion

- Printing plate samples for this paper were made in defined processing conditions with variations of the UVA and UVC post-treatment
- Surface free energy calculations and FTIR spectra analysis were performed on samples of flexographic printing plates
- Prolonged UVA post-treatment results with the decrease of the total surface free energy, especially its dispersive component

- Prolonged UVC radiation results in process similar to the oxidation of the material – integration of the oxygen in form of certain functional groups in the surface layer of the printing plate, leading to the increase in the total surface free energy

- The changes in the surface free energy can influence the process of printing ink transfer from anilox roller to the printing substrate in the reproduction process

- FTIR analysis proved to be an useful method for characterization of changes in the photopolymer material

Thank you for your attention!

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