INNOVATIVE PHOTOINITIATING SYSTEMS NEW OPPORTUNITIES FOR THE COATINGS INDUSTRY

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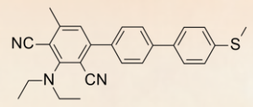
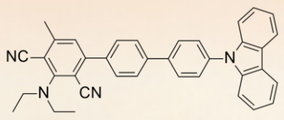
INTRODUCTION

Currently, the polymer industry is looking for fast and versatile initiation systems to optimize the production process and also to improve the quality of the final product. The versatility of photoinitiators in this case is related to the possibility of simultaneous initiation of different types of polymerization reactions. Moreover, modern processing market uses as a source of light i.e. lamps based on electroluminescent diodes, which are supposed to be an ecological alternative for mercury lamps used so far. However, the problem is the incompatibility of absorption characteristics of commercially used initiators with the emission characteristics of industrial light sources. Therefore, new versatile photoinitiating systems dedicated to various types of polymerization reactions: radical, cationic and hybrid were developed, which additionally show compatibility with emission of commercially available light sources: UV-LEDs and Vis-LEDs.

MATERIALS

BIPHENYL DERIVATIVES


BANS 25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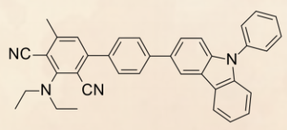
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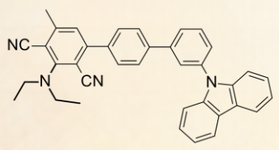
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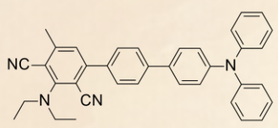
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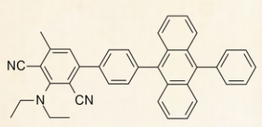
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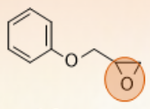
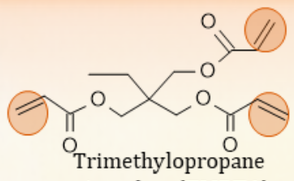
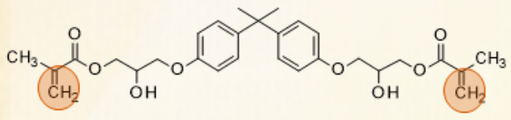
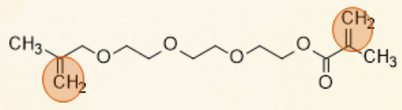
MONOMERS

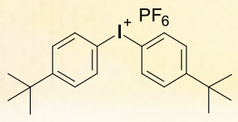

1,2-epoxy-3-phenoxypropane (**EPXPROP**)


Trimethylopropane triacrylate (**TMPTA**)

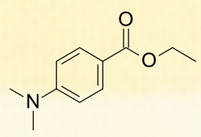

bisphenol A-glycidyl methacrylate (**BisGMA**)


triethylene glycol dimethacrylate (**TEGDMA**)

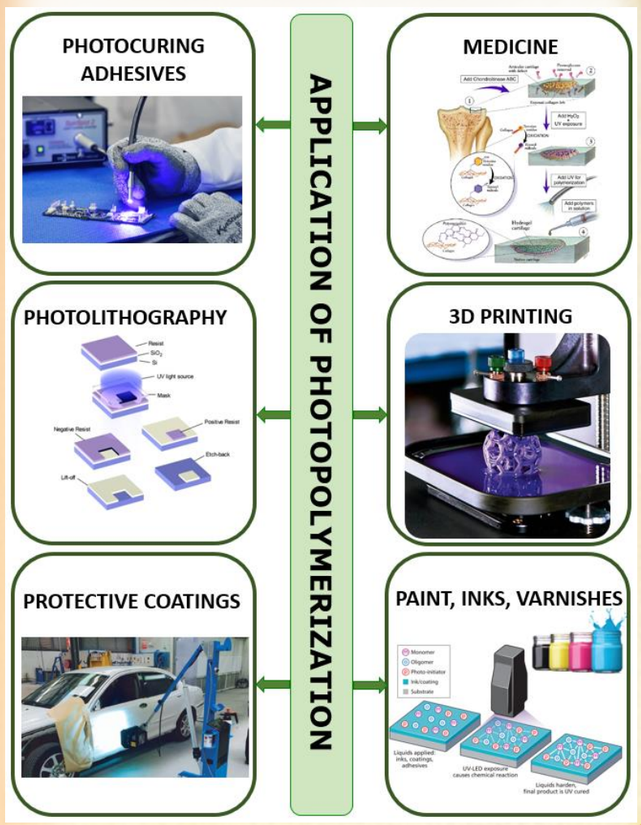
PHOTOINITIATOR


bis-(4-t-butylphenyl)iodonium hexafluorophosphate (**Speedcure 938**)

CO-INITIATOR


Ethyl 4-(dimethylamino) benzoate (**EDB**)

APLICATION AREAS OF PHOTOPOLYMERIZATION PROCESSES



COATING WITH LIGHT-CURING RESINS

No yellowing of coatings! **Fluorescent coatings!**

Fig. 1. Photographs of coatings obtained using the developed resins containing biphenyl derivatives as a component of the photoinitiating system.

THICK FILM PHOTOCURING

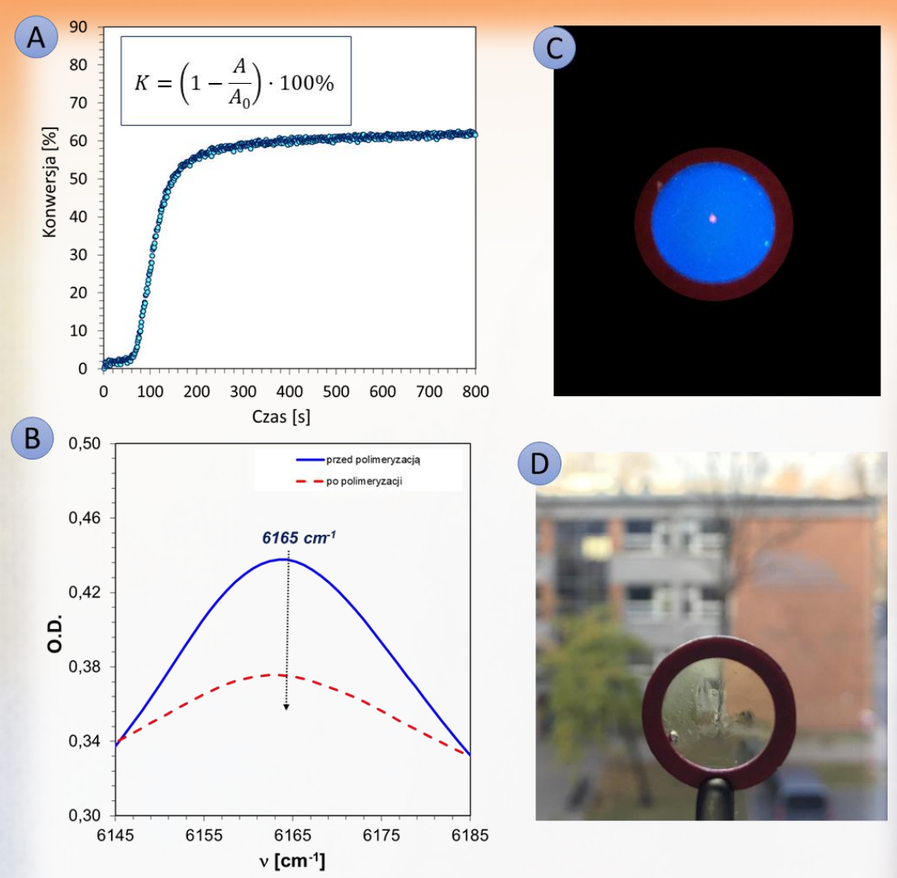


Fig. 2. A: Kinetic profiles showing the progress of radical photopolymerization of TEGDMA/bisGMA monomer mixture upon irradiation with light at 365 nm; B: FT-IR spectrum changes for the composition based on TEGDMA/bisGMA monomer mixture before and after radical photopolymerization process upon irradiation with 365 nm UV-LED; C: Exposure of a composition of monomer mixture and initiatING system after fotopolymerization process upon irradiation with UV-LED @365 nm; D: Daylight view of the compositions from point C.

APPLICATION STUDIES OF HIGHLY EFFECTIVE NEW GENERATION INITIATION SYSTEMS

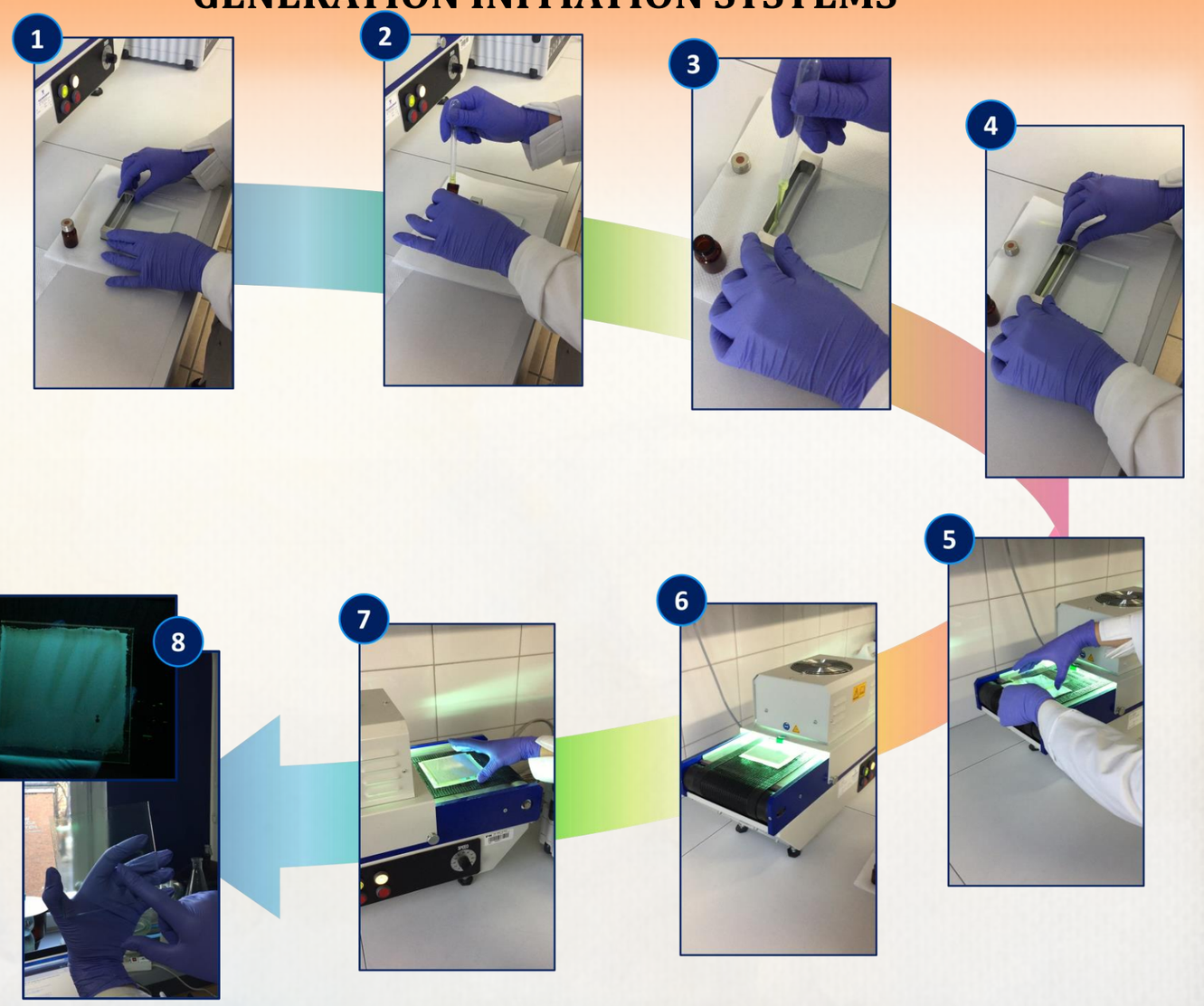


Fig. 3. Application studies of highly effective new generation initiation systems: steps for obtaining polymeric photo-curable coatings

BENEFITS OF THE SOLUTION

REQUIREMENT	SOLUTION FEATURES
The best possible match between the absorption spectrum and the emission spectrum of the light source,	Absorbance studies of co-initiators have shown that these compounds absorb light up to a wavelength of max. 420 nm, so they overlap with the emission ranges of the light sources used based on UV-LEDs, Vis-LEDs
high quantum efficiency,	as a result of the investigations, quantum yields of the studied compounds were determined, whose values clearly indicate the suitability of the derivatives for the role of co-initiators, which is confirmed by further polymerization studies and electrochemical calculations
good solubility in the polymerized composition,	during preparation of the compositions for the experiments, very good solubility of the co-initiators in the mixtures consisting additionally of iodonium salt and appropriate monomers was observed
thermal and temporal stability	tested compounds are not sensitive to elevated temperatures (atmospheric conditions) and do not lose their properties over time

ACKNOWLEDGMENT

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Project title: *Implementation of photogenerated strong protic acids (PAG-s) based on innovative accelerating molecules for application in the industry of photo-curable polymer coatings,* **Project number: TANGO2/340229/NCBR/2017 - NCBiR**