APPLICATIONS OF CARBON DOTS TO A NANO-PHOTOINITIATING SYSTEM IN CATIONIC PHOTOPOLYMERIZATION

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Cutting-edge technologies employed to fabricate various polymer materials are based on photoinitiated processes. Due to the growing interest in photopolymerization, novel types of high-efficient photoinitiating systems have been developed since both the efficiency and the polymerization rate depend on their properties. In current technology, it is becoming necessary for innovative initiator systems to operate using ultraviolet (UV) and visible (Vis) light in the emission range of UV-LEDs and Vis-LEDs. The binary initiator systems, containing an iodonium salt and a photosensitizer involve a photoinduced electron transfer process between the photosensitizer and the iodonium salt. Therefore, carbon dots derived alone from citric acid (CA-CDs) and doped with amine (N-doped-CA-CDs) and sulfur (N,S-doped-CA-CDs) precursors were used as multipurpose iodonium salt photosensitizers for the cationic photopolymerization of vinyl and epoxy monomers. The real-time Fourier transform infrared spectroscopy (real-time FT-IR) was used to monitor the photopolymerization. The oxidation potentials of the presented carbon dots were also measured and the value of the change in the free energy of electron transfer between the individual components of the photoinitiating system was calculated. Consequently, the possibility of using carbon dots as sensitizers for cationic ring-opening photopolymerization of epoxy monomer CADE was investigated. As a result, the effectiveness of the developed IOD/CDs initiator systems in the light-initiated polymerization of epoxy monomers was chosen to be investigated. An initiator system supported by a silane additive was selected for this type of polymerization: IOD (2.0 wt.%), TTMSS (2.0 wt.%) and various carbon dots (0.2 wt.%) calculated against the epoxy monomer CADE content. A UV-safe LED @365 nm was used as the light source and the reactions were carried out in the air for 800 s. The experiments revealed that during photopolymerization, the investigated carbon dots are well suited to act as highly effective photosensitizers in a two-component initiator system.

Acknowledgements

This research was funded by the Foundation for Polish Science (Warsaw, Poland) TEAM TECH project Grant No. TEAM TECH/2016-2/15 (POIR.04.04.00-00-204B/16-00).

Additionally, research of synthesis of CDs was supported by Polish National Agency for Academic Exchange (The Bekker Programme No. PPN/BEK/2018/1/00460/U/00001).