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Photochromic properties of 1′,3′,3′ -trimethyl-6- nitrospiro[2H-1-benzopyran-2,2′-indoline] doped in PMMA and epoxy resin thin films

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Abstract

Purpose - The purpose of this paper is to evaluate the photochromic performance of photochromic compounds in polymer matrices. Design/methodology/ approach - The poly(methyl methacrylate) (PMMA) and epoxy resin doped with photochromic spirobenzopyran were prepared and the effects of ultraviolet (UV) irradiation were studied using spectrophotometer. The reversible reaction was effected using white light. Photochemical fatigue resistance of these films was also studied. Findings - Irradiation of colourless 1′,3′,3′- trimethyl-6-nitrospiro[2H-1-benzopyran-2,2′-indoline] spiropyran (SP) doped in PMMA and epoxy resin with UV light (366 nm) results in the formation of an intense purple-red coloured zwitterionic photomerocyanine (PMC). The reverse reaction was photochemically induced by irradiation with white light. Photocolouration of SP doped in PMMA follows a first-order rate equation (k = 0.0011 s⁻¹), while that doped in epoxy resin deviates from linearity. It was found that photobleaching follows a first-order equation in both matrices. The photobleaching rate constant of PMC in both matrices is the same and equals 0.0043 s⁻¹. Spirobenzopyran doped in PMMA shows better fatigue resistance than that doped in epoxy resin. Research limitations/ implications - The PMMA and epoxy resin polymers doped with photochromic spirobenzopyran described in the present paper were prepared and studied. The principle of study est blished can be applied to any type of polymer or to any type of photochromic compounds. Practical implications - The photochromic materials developed can be used for different applications, such as coatings and holography. Originality/value - The method developed may be used to enhance the performance of photochromic materials. © Emerald Group Publishing Limited [ISSN 0369-9420].

Author Keywords

Electromagnetic radiation; Epoxy resins; Films (states of matter); Thermoplastic polymers