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Photoresponsive Azobenzene-Containing PMMA as Smart Coatings with Reversible Surface Polarity

Shameer Hisham^{a,*}, Norazilawati Muhamad Sarih^a, Hairul Anuar Tajuddin^a, Zul Hazrin Zainal Abidin^b

^aDepartment of Chemistry, Faculty of Science, Universiti Malaya, 50603 Kuala Lumpur, Malaysia.

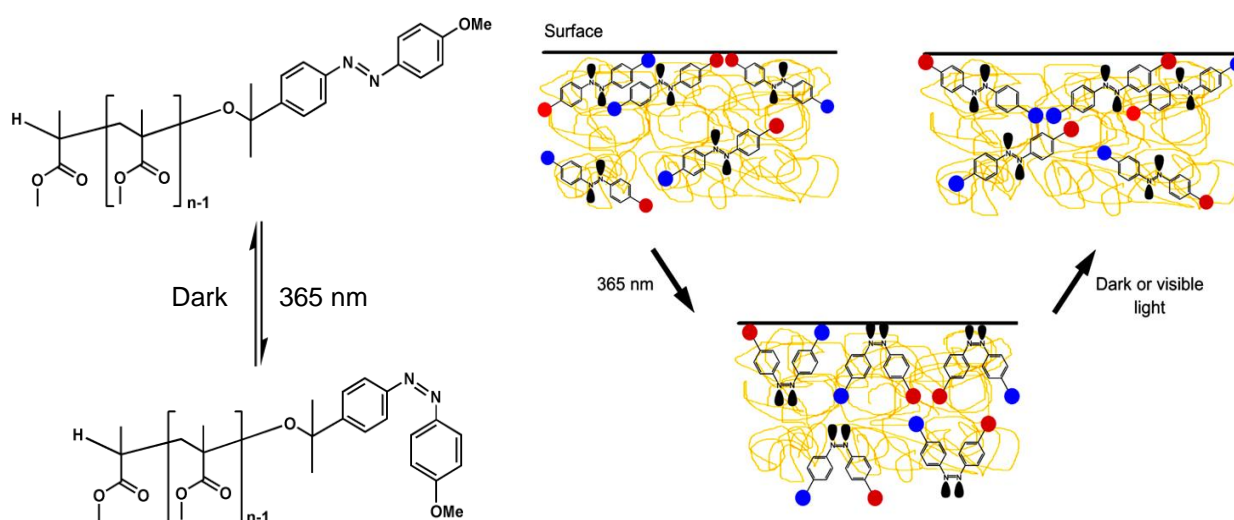
^bCentre for Ionics University of Malaya, Department of Physics, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia.

*Corresponding author: shameerh@um.edu.my

Abstract

Illegal advertisement stickers still exist as a recurring problem, especially in urban areas. Removing them requires mechanical forces or chemicals, which often leads to residues remaining on walls and surfaces, causing damage and hideous appearance of surfaces. Moreover, repairing these surfaces requires high costs. It is proposed that surfaces with reversible polarity, particularly from the additive component, can cause the surface to gradually reduce the interactions and any stickers can peel off by itself. Thus, we described the formulation and the application of poly(methyl methacrylate), PMMA blends containing photoresponsive dyes as smart coatings that were capable of photoreversibly switch surface polarities. The blends contained various azobenzene derivatives including an azobenzene end-functionalized PMMA additive (**P1**), which were then applied onto clear glass substrates as coating films. A proof-of-concept work showed that these PMMA/azobenzene coatings were able to remove stickers by itself due to the repetition of *trans*-*cis* isomerization of azo dyes in the coating upon UV-A irradiation, resulting in a considerable alteration to the sticker/coating interactions¹. It was discovered that thermal annealing of PMMA/**P1** coating film above the glass transition temperature, T_g allowed the segregation of **P1** macromolecules to the surface, resulting in enhanced changes in the surface polarity. In addition, the annealed PMMA/**P1** coating film has shown better performance in the sticker peel-off test compared to that of the unannealed coating film. These fundamental discoveries would lead to more development of smart coatings based on simple PMMA/azobenzene blends, where they can be used as a prospective solution to retard problems associated with commercial stickers.

Keywords: Smart coatings; Surface polarity; Azobenzenes; End-functionalized PMMA; Photoisomerization.



References

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