A NOVEL DISULFIDE-CONTAINING MONOMER FOR PHOTOINITIATOR-FREE SELF-HEALABLE PHOTOCURED COATINGS

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In recent years, UV-curable coatings have slowly replaced solvent-based ones, mainly due to their sustainable features such as low energy consumption and fast curing process. Crosslinked photocured networks containing linear disulfides have attracted a lot of attention due to the peculiar properties and responsiveness of S-S bonds[1], which make them suitable for several applications, chief among them self-healable materials[2,3]. Indeed disulfide bonds are recognized for their sensitivity to several stimuli, and cleavage of disulfide with the formation of thiyl radicals could be easily achieved.

Based on these distinctive features, herein a novel photocurable diacrylated polyurethane monomer containing disulfide bonds (DSPDA)[4] was synthesized through a one-step process without the need for further purification. The photopolymerization kinetics of the monomer was studied through real-time FTIR, highlighting a fast and complete conversion. High acrylate conversions were reached even in the absence of a photoinitiator, thus demonstrating the self-initiating capabilities of the synthesized monomer thanks to disulfide cleavage and thiyl radicals generation upon UV light exposure. Clear coatings were produced using DSPDA monomer and disulfide dynamicity was exploited to obtain self-healing of surface scratches after heat application.

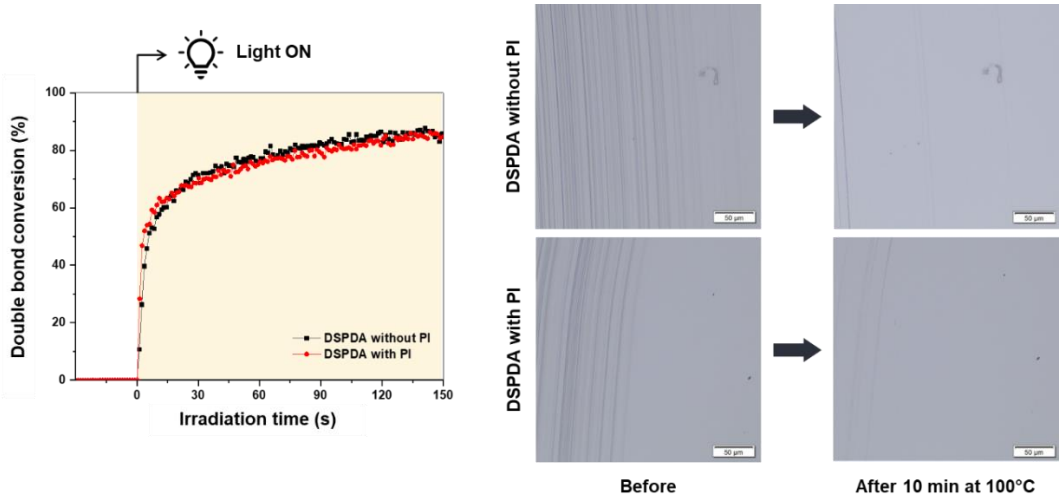

Figure 1: Photocuring kinetics of DSPDA (left) and self-healing of surface scratches in DSPDA coatings (right)

[1] M. Zhang, S. Jiang, Y. Gao, J. Nie, F. Sun, 2020, *Chem. Eng. J.*, **390**, 124625
[2] L.M. Saiz, M.G. Prolongo, V. Bonache, A. Jiménez-Suarez, S.G. Prolongo, 2023, *Polym. Test.*, **117**, 107832
[3] X. Li, R. Yu, Y. He, Y. Zhang, X. Yang, X. Zhao, W. Huang, 2019, *ACS Macro. Lett.*, **8**, 1511-1516
[4] A.Spessa, R.Bongiovanni, A.Vitale, 2024, *Prog. Org. Coat.*, **187**, 108098