

Synthesis of P(EGMEA3-g-ENR1) by UV-photopolymerization and investigation of the effect of different photoinitiator concentrations

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This study presents the synthesis of a novel graft polymer material through UV-induced photopolymerization of epoxidized natural rubber (ENR) with ethylene glycol methyl ether acrylate (EGMEA), using 2,2-Dimethoxy-2-phenylacetophenone (DMPA) as a photoinitiator. The focus lies in developing a high-performance polymer matrix with tunable properties for potential use in energy storage applications, such as polymeric binders or electrolytes. By systematically varying the DMPA concentration, the photografting process was optimized to balance reaction kinetics, grafting efficiency, and structural uniformity. As shown in Figure 1 and Figure 2, In situ Raman spectroscopy enabled real-time monitoring of the reaction, revealing the influence of initiator content on the progression and completion of grafting ^[1]. Complementary infrared (IR) spectroscopy confirmed the formation of grafted structures, indicating successful integration of methacrylate units into the ENR backbone ^[2]. The study highlights the critical role of photoinitiator dosage: insufficient or excessive DMPA adversely affects polymerization, either through incomplete grafting, light absorption competition, or residual content. The optimized synthesis route yields a new class of UV-curable elastomeric materials with improved efficiency, reduced processing time, and enhanced compatibility for battery-related applications. This work provides a promising pathway for the development of functional polymer systems with tailored performance via light-driven synthesis techniques.

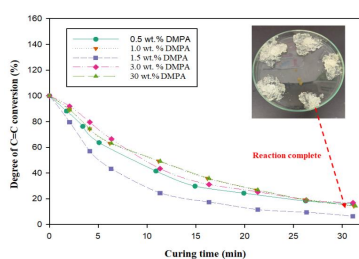


Figure 1

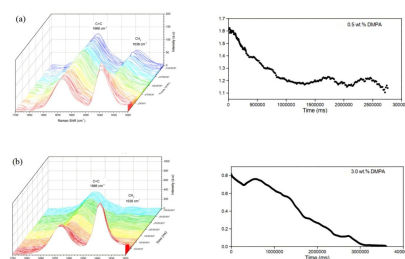


Figure 2

Figure 1. Effect of DMPA Concentration on C=C Conversion during UV Curing Process

Figure 2. (a) 3D Raman spectra of 0.5 wt.% DMPA and the corresponding intensity ratio of the C=C (1666 cm^{-1}) to CH_3 (1638 cm^{-1}) bands as a function of reaction time (b) 3D Raman spectra of 3.0 wt.% DMPA and the corresponding intensity ratio of the C=C (1666 cm^{-1}) to CH_3 (1638 cm^{-1}) bands as a function of reaction time

References:

- [1] N. J. Azaki, et.al., *ACS Appl. Polym. Mater.*, **5** (2023) 4953-4956.
- [2] Y. Wang, et.al., *Polym. Chem.*, **11** (2020) 3268-3279.