ENHANCED CONDUCTIVITY OF EPOXY-FILLED CARBON BLACK CONDUCTIVE INK VIA GREEN CO-SOLVENT TECHNIQUE ON PET SUBSTRATE

NUR AISYAH AMIRAH BINTI ABDUL RAZAK

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Dr Zuliahani Ahmad
Supervisor
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

_____

Dr Siti Nurlia Binti Ali
Project Coordinator
B.Sc. (Hons.) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

_____

Dr Nur Nasulhah Binti Kasim
Head of Programme
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Date:_____

ABSTRACT

ENHANCED CONDUCTIVITY OF EPOXY-FILLED CARBON BLACK CONDUCTIVE INK VIA GREEN CO-SOLVENT TECHNIQUE ON PET SUBSTRATE

Epoxy based conductive ink is widely used in various electronic applications. However, epoxy alone is a non-conductive material, but if combined with carbon black filled epoxy it can become conductive. The objectives of this research is to prepare and characterize the various loading of CB (0%, 5%, 10%, 15% and 20%) filled epoxy conductive ink using Fourier Transform Infrared Spectroscopy (FTIR) and Ultraviolet-Visible Diffuse Reflactance Spectra (UV-Vis/DRS) and to determine the conductivity properties on various loading of CB (0%, 5%, 10%, 15% and 20%) filled epoxy conductive in via Electrochemical Impedance Spectroscopy (EIS) and Multimeter. As opposed to other harmful techniques, the green co-solvent technique using ethanol and distilled water was used in this study and used SDS as a surfactant.. Then PET substrate was printed using print screen method. The CB-epoxy conductive ink's conductivity is predicted to be improved via addition of CB. From FTIR testing, CB peak shows greater shift towards higher wavenumber at 1607 cm^{-1},indicating increased wavenumber at C=C stretching, contrasting 0%'s peak at 1605 cm^{-1}. This demonstrates that adding CB loadings causes the wavenumber to increase. The UV-Vis spectroscopy results for the CB-epoxy composite show two stretch peaks between 310 and 370 nm. The elongated double bond that is linked to $\pi - \pi^*$ transitions is believed to be the cause of CB's conductivity properties. The increased surface area of the carbon compounds exposed to UV light is most likely attributed to the resulting $\pi - \pi^*$ transitions. The results of the multimeter testing indicate that the resistivity and conductivity are inversely related. The resistivity increases from 1548.450 Ω.m to 3017.829 Ω.m when the percentage of CB was reduced from 15% to 0%. At 15% of CB it shows the highest conductivity with the lowest resistivity which is at 6.458 x 10^{-4} S/m and 1548.450 Ω.m respectively. Using EIS, 15% of CB shows the smallest curve among other CB loadings. This is further confirmed by 15% of CB formulation that has highest purity, causing epoxy decreasing resistance and increasing conductivity in epoxy-filled CB samples. According to the study, 15% CB is optimum loading form all the testing have been done. From this research, we have identifies optimal carbon black loading for epoxy-based conductive inks, improving electrical conductivity and enhancing performance of conductive ink.

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