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Hairi, N.I.I.M.[a] , Md Ralib, A.A.[a] , Nordin, A.N.[a] , Rahim, R.A.[a] , Yunos, M.F.A.M.[b] , Ming, L.L.[c]

Chitosan as Natural Binder for Eco-Friendly Printable Conductive Ink

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[a] Kuliyyah of Engineering, IIUM, Department of Electrical and Computer Engineering, Kuala Lumpur, Malaysia
[b] IIUM, Jabil Circuit Sdn. Bhd, Malaysia, Department of Electrical and Computer Engineering, Malaysia
[c] Jabil Circuit Sdn. Bhd, Penang, Malaysia

Abstract
Conductive inks have been extensively investigated in printed electronics for the development of wearable devices. Typical conductive inks consist of conductive filler, polymer binder and solvent. However, involvement of synthetic polymer binder in printable conductive ink emits volatile organic compounds (VOCs) that can impact human health. Chitosan (CS) biopolymer provides alternative solution as natural binder because it exhibits high tensile strength, non-toxic and environmental-friendly. Hence, the objective of this paper was to evaluate chitosan as a natural binder for eco-friendly printable conductive ink. The CS and multi-walled carbon nanotube (MWCNT) were synthesized and characterized using FESEM, Raman spectroscopy and FTIR analysis. The conductivity and bending test of CS/MWCNT printable conductive ink were evaluated. Rheological properties of CS/MWCNT printable conductive ink recorded viscosity of 1 Pa•s and behave as non-Newtonian fluid with shear-Thinning characteristic. Homogenous dispersion and proper disentanglement of MWCNT fillers within CS polymer was depicted through surface morphology analysis. Raman and FTIR analysis illustrated that CS were successfully synthesized with MWCNT filler. The measured conductivity for CS/MWCNT printable conductive ink was 4.46 x 10-3 S/m which was comparable to the previous work. The bending test proved that higher weightage of CS will result to strong bond between CS and MCWNT and can prevent crack, resulting to flexible CS/MWCNT printable conductive ink. Therefore, integration of CS as natural binder for eco-friendly printable conductive ink provides promising solution for printed electronics applications. © 2023 IEEE.

Author Keywords
chitosan/MWCNT; natural binder; printable conductive ink

Index Keywords
Biopolymers, Chitosan, Environmental protection, Filled polymers, Fillers, Morphology, Multiwalled carbon nanotubes (MWCN), Non Newtonian flow, Non Newtonian liquids, Rheology, Shear thinning, Surface morphology, Tensile strength; Chitosan/multi-walled carbon nanotube, Conductive ink, Eco-friendly, FTIR analysis, Multi-walled-carbon-nanotubes, Natural binder, Polymer binders, Printable conductive ink, Printed electronics, Synthesised; Fourier transform infrared spectroscopy

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Correspondence Address
Hairi N.I.I.M.; Kuliyyah of Engineering, Malaysia; email: iffah.irdina@live.iium.edu.my

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