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Impact of SiO_2–GO hybrid nanomaterials on opto-electronic behavior for novel glass quinary (PAAm–PVP–PVA/ SiO_2–GO) hybrid nanocomposite for antibacterial activity and shielding applications

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Abstract
Silicon dioxide and graphene oxide nanomaterials (SiO_2–GO) NMs were mixed with reinforcing ternary blend polymer, polyacrylamide (PAAm) blended with polyvinyl pyrrolidone (PVP) and poly (vinyl alcohol) (PVA). PAAm–PVP–PVA. Several loading ratios of SiO_2 nanoparticles and syntheses GO nanosheets (SiO_2–GO) NMs (SiO_2–GOx) (x = 0, 0.01, 0.03, and 0.05 wt%) were loaded to reinforce and fabricated novel glass of the fabricated as quinary-based-hybrid nanocomposites using advanced acoustic-sonication-casting technology. Several characterizations were used to investigate the samples: X-ray diffraction (XRD), infrared Fourier-transform spectroscopy (FTIR), optical microscopy (OM), field emission scanning electron microscope (FESEM), UV–visible spectrophotometer, electrical meter, antibacterial activity, and gamma-ray detection. Significant bonds between the component matrix were exhibited in FTIR spectra, with acceptable homogeneity grainy and rough surfaces that defected using FESEM within the keep of good transparency as presented by OM. XRD patterns for samples showed a similar behavior of PAAm with shifting. NMs contribution revealed significant modification of the structure, the disappearance of surface creaks, and notable improvements in the properties of quinary hybrid nanocomposites. Absorption behavior significantly enhanced at (200 nm) up to 37%. The energy gap improved by 10% and 19% for allowed indirect and forbidden indirect transitions, respectively. The dielectric and loss constants were notably enhanced up to 273%. Excellent improvement was presented in the electrical conductivity results, reaching up to 207%. SiO_2 and GO NMs exhibited notable changes in inhibited zone antibacterial activity from 00 up to 27 and 25 mm of *Staphylococcus aureus*, *Escherichia coli*, respectively, compared to the polymer matrix. Samples exhibited significant attention to gamma radiation rays up to 145%. These findings presented promising materials for various requirements, such as solar cells, biology sensors, and light shielding applications.

Keywords SiO_2 · PAAm · GO · PVP · Optical · PVA · Electronic · Shielding · Antibacterial

Extended author information available on the last page of the article

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