SCHOLARLY PUBLICATIONS
School of Mechanical Engineering
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Journal Name: Applied Surface Science Advances **IF: 7.5**

Title: Flexible PMN-PT/rGO/PVDF-TrFE based composites for triboelectric and piezoelectric energy harvesting

Author: Das S.; Mallik M.; Parida K.; Bej N.; Baral J.

Details: Volume 23, September 2024, Article number 100626

Abstract: Flexible piezoelectric nanogenerator (PENG) and triboelectric nanogenerators (TENG) have gained prodigious attention due to the increasing demand of nano and micro energy for driving of miniaturized electronic devices, sensors, and various internet of things. The key challenges that are currently in focus are material selection and simple fabrication techniques for improved electrical performance along with good mechanical properties and flexibility. Herein, a ferroelectric polymer, poly(vinylidenefluoride-co-trifluoroethyne) (PVDF-TrFE), is chosen as a flexible material due to its promising prospect for energy harvesting. To improve the performance, a ceramic material, $0.65Pb(Mg_{1/3}Nb_{2/3})O_3–0.35PbTiO_3$ (PMN-PT), with very high piezoelectric properties has been selected as the reinforcement. Further, reduced graphene oxide has been added as a conducting filler to promote charge conduction. A remarkable enhancement in output voltage of nearly 3 fold is achieved in PVDF-TrFE/PMN-PT (PP) polymer composite as compared to the base polymer PVDF-TrFE (P) TENG device. Furthermore, the PVDF-TrFE/rGO/PMN-PT (PPR) as a PENG illustrates a great improvement in output current of the order of 2 as compared to the pristine polymer. The maximum output voltage as shown by the TENG is 200 V and the maximum current that is shown by the PENG is 30 μA. Therefore, the fabricated PMN-PT based PVDF-TrFE nanogenerators have an immense prospect for applications in self-powered systems.

URL: https://www.sciencedirect.com/science/article/pii/S2666523924000540?via%3Dihub

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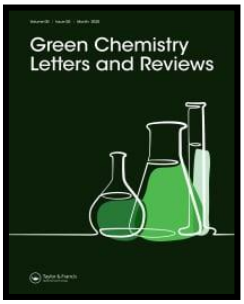
Journal Name: **Green Chemistry Letters and Reviews** **IF: 5.8**

Title: Microwave-assisted green synthesis of silver nanoparticles using Mitragyna parvifolia bark extract and their biological activities: an economical and environment-friendly approach

Author: Dwivedi, A; Das, S; Tiwari, V; Yadav, V; Jain, SK; Mandal, V; Mukherjee, S; Satpathy, S; Mohapatra, D; Sahu, AN; Satpathy, MP; Mehta, SK; Singh, S; Goyal, M; Kazi, M; Hussain, MD; Patra, A

Details: Volume 17, Issue 12024 Article number 2395919

Abstract: Nowadays, nanotechnology is extensively employed in the medical profession. In this study, we used the aqueous extract of the bark of Mitragyna parvifolia to synthesize silver nanoparticles (AgNPs) by microwave-assisted green synthesis. The synthesis of AgNPs was confirmed by visual color change to brown color and characteristic surface plasmon resonance peak at 432 nm. The hydrodynamic diameter of the AgNPs was 171.81 nm having a zeta potential of −24.14 mV; Fourier Transmission Infrared Spectroscopy confirmed the presence of different functional groups on the NP surface; Scanning Electron Microscope and High-Resolution Transmission Electron Microscopy indicated predominantly circular shape of nanoparticle; Selected Area Electron Diffraction and X-ray Diffraction analyses determined the crystalline structure of AgNPs. Energy-Dispersive X-ray indicated the elemental composition and formation of AgNPs. The AgNPs were screened at different concentrations for antioxidant activity, antimicrobial, and anticancer potential in breast cancer cells (MCF-7 and MDA-MB-231). The AgNPs exhibited remarkable antioxidant, antimicrobial, and anticancer activities. The sedative and antinociceptive activities were also tested on Swiss albino mice, which showed mild sedative and very potent antinociceptive activity. However, detailed mechanistic studies are warranted in the future for clinical application of the AgNPs as a biologically active agent as well as a carrier for drug delivery.



URL: https://www.tandfonline.com/doi/full/10.1080/17518253.2024.2395919

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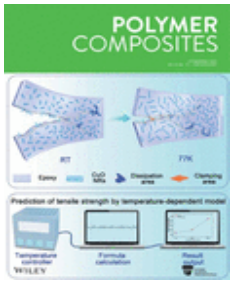
Journal Name: **Polymer Composites** **IF: 4.8**

Title: Enhancing mechanical and tribological performance of hybrid composites: An experimental study utilizing response surface methodology and firefly algorithm

Author: Dash S.; Satpathy M.P.; Routara B.C.; Pati P.R.; Gantayat S.

Details: 2024

Abstract: This study emphasizes the significance of stacking sequence and hybridization of glass, carbon, kevlar and basalt fibers to enhance the mechanical characteristics and the overall wear response of polymer composites. The carbon layer on the outside of the composite exhibited higher ultimate tensile and flexural strengths. The abrasive wear of fabricated hybrid composites is also explored by performing experiments using Box–Behnken design approach. The pin-on-disc tester is utilized to do the wear test by varying composite type, sliding distance, and sliding velocity, with specific wear rate (SWR) serving as the response parameter. Regression analysis is performed to predict SWR using control and response parameters derived from experimentation. A novel firefly algorithm technique is adopted to determine the optimal process parameter combination. By utilizing optimized parameters (430 m, 10.5 m/s, and the CKBG4BKC stacking sequence), the SWR is considerably reduced to 16.82 × 10^{-5} mm^3/Nm. Scanning electron microscopy on the worn-out wear surface reveals enhanced interfacial bonding, fiber breakage and plowing as the fundamental wear mechanism. This work provides insight into hybrid composites for constructing aircraft and automobile body structures, where they provide an optimal blend of strength, sustainability, and structural performance. Highlights: Hybrid composite: Stacking sequence impacts on mechanical and abrasive wear. Box–Behnken design: Applied on stacking order, sliding distance and velocity. Utilizing metaheuristic firefly algorithm to enhance specific wear results. Optimal parameters: 430 m, 10.5 m/s, and CKBG4BKC stacking sequence. Lightweight, high-strength, cost-effective, and sustainable hybrid composites.



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SCHOLARLY PUBLICATIONS
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Journal Name: Materials Chemistry and Physics **IF: 4.3**

Title: Synthesis and tribological characterization of cold-sprayed Ni-based composite coatings containing Ag, MoS2 and h-BN

Author: Singh Gautam R.K.; Mishra I.P.; Tripathi V.M.; Mishra S.; Ahmed Z.; Jha P.; Nautiyal H.

Details: Volume 3251, October 2024, Article number 129652

Abstract: The tribo components often fail to perform in a desired way due to absence of adequate lubrication in severe conditions and may cause loss of material. Even under room temperature (RT), it is desirable to maintain the proper lubrication for efficient functioning. In recent years, many efforts have been made to develop a coating material which can facilitate low friction and wear properties in diverse working conditions. The proper use of the solid lubricants can deliver utmost lubricity and, therefore, minimize the loss of materials. Solid lubricating coatings have found various industrial applications in harsh environmental conditions, such as in internal combustion engine, gas turbine and aircraft. As far as development of coating is concerned, cold spray (CS) technology has been observed to develop the coatings at relatively low temperature (avoids decomposition) as compared to conventional thermal spray technologies (plasma spray & high velocity oxy fuel). In the current investigation, synergistic response of the participating solid lubricants viz. silver (Ag), molybdenum disulfide (MoS_2) and hexagonal boron nitride (h-BN) on the tribological properties of the developed coatings were studied in various working regime of loads. The tribological characteristics of different composite coatings, such as NiAl-MoS_2-Ag (NB0), NiAl-MoS_2-Ag-5 wt. % hBN (NB5), NiAl-MoS_2-Ag-7.5 wt % hBN (NB7.5) and NiAl-MoS_2-Ag-10 wt % hBN (NB10) against alumina ball were explored at various loads (6, 11, 16 and 21 N) and at a fixed speed of 0.3 m/s under room temperature (RT). The fixed concentration of Ag and MoS_2 with varying weight percentage of h-BN (0, 5, 7.5 and 10 wt %) were introduced as solid lubricants for evaluating the lubricating potential of h-BN. During the tests, coefficient of friction (COF) and wear rate were observed to lessen as the load increased from 6 to 16 N. However, increased COF and wear rate were noticed for all the participating coatings at higher load (21 N). The ideal content of hBN in the deposited coatings was ascertained in order to get the utmost favourable lubricating conditions. It was observed that NB7.5 coating exhibited the enhanced tribological characteristics under the aforesaid operating conditions. Coating NB7.5 shows the best friction and wear characteristics during each testing load and reached a COF (0.19) and wear rate (2.1×10^{-5} mm^3/Nm) at 16 N load. The observed wear mechanisms were analysed on the basis of the synergy shown by Ag, MoS_2, and hBN as well as the optimal hBN level in the coating (NB7.5) which helped in attaining the improved tribological properties.

URL: https://www.sciencedirect.com/science/article/pii/S0254058424007776?via%3Dihub