SCHOLARLY PUBLICATIONS
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Journal Name: **Applied Surface Science Advances** **IF: 7.5**

Title: Investigation of mechanical morphological structural and electrochemical properties of PVD TiAlN coating: A detail experimental and its correlation with an analytical approach using the least square method

Author: Das S.; Biswas S.K.; Kundu A.; Ghadai R.; Guha S.

Details: Volume 24, December 2024

Abstract: In this experimental investigation, a Physical Vapor Deposition (PVD) process was employed to deposit TiAlN coating onto a Si substrate. The nitrogen flow rate, bias voltage, and substrate-to-target distance were selected as input parameters, each with three different levels. The design of these input parameters was structured according to Taguchi's L9 Orthogonal Array (OA). Following deposition, the mechanical, microstructural, structural, and electrochemical properties of the TiAlN coating were meticulously characterized and analyzed to discern the influence of the selected parameters on its various properties. Microstructural analysis revealed a homogeneous structure throughout the film. Additionally, the mechanical properties of the film exhibited notable performance under the specified parameters. However, it was observed that no consistent trend could be identified across different properties concerning the applied parameters. To elucidate the complex relationships among these variables, the Least Squares Method (LSM) regression analysis technique was employed. This analytical approach facilitated the establishment of correlations among the diverse parameters, enhancing the understanding of their collective impact on the TiAlN coating properties. The understanding of analytical results will be useful for predicting the values between the two extremities to measure the performance parameters where the experimental results are not available.

URL: https://www.sciencedirect.com/science/article/pii/S2666523924000667?via%3Dihub

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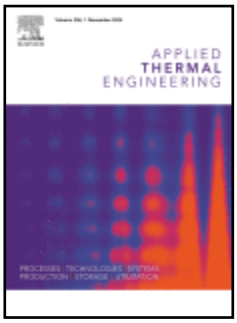
Journal Name: **Applied Thermal Engineering** **IF: 6.1**

Title: Enhancing heat transfer and minimizing entropy generation with mono and hybrid nanofluids: An experimental study

Author: Mukherjee S.; Ebrahim S.A.; Mishra P.C.; Chaudhuri P.; Ali N.

Details: Volume 257, December 2024

Abstract: The article extensively studies heat transfer enhancement and entropy generation minimization using mono and hybrid nanofluids. Three nanofluid types were investigated:SiO_2/Water, MgO/Water mono nanofluids, and SiO_2-MgO/Water hybrid nanofluids, all at 0.03% mass concentration. Testing involved different fluid flows at varying mass flux from 66.35 to 597.13 kg/m^{2}s through an uniformly heated tube subjected to a constant heat flux of 9,673W/m^2. Variation in SiO_2:MgO mass ratio (2:3, 1:1, 3:2) was considered. Results showed heat transfer improvement in MgO/Water mono and SiO_2-MgO/Water hybrid nanofluids, while SiO_2/Water mono exhibited no enhancement. The pressure drop increased from 0.007 to 0.310 bar with the increase in mass flux of the flow. However, it remained consistent for all fluids. Total entropy generation analysis revealed reduced values for hybrid and MgO/Water mono nanofluids in the range of 83.43–86.71% with the rise in mass flux flow rate. Whereas, SiO_2/Water mono nanofluid exhibited 90.76% reduction in total entropy generation with the rise in mass flux. However, the SiO_2/Water displayed higher values of total entropy generation from any other working fluid in the experiment. When compared to water,hybrid and MgO/Water mono nanofluids showed reduced total entropy generation. The SiO_2-MgO/Water hybrid nanofluid at 2:3 mass ratio stood out with a 94.25% heat transfer coefficient enhancement and 48.08% entropy generation minimization at 287.50 kg/m^{2}s mass flux. Finally, the exergetic merit analysis recommends SiO_2-MgO/Water hybrid nanofluid at 2:3 mass ratio for superior heat transfer and entropy minimization in industrial applications, holding potential for enhanced heat transfer systems.



URL: https://www.sciencedirect.com/science/article/pii/S1359431124020854?via%3Dihub

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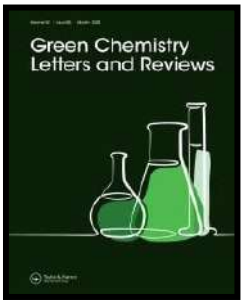
Journal Name: **Green Chemistry Letters and Reviews** **IF: 5.8**

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

SCHOLARLY PUBLICATIONS
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Journal Name: **Surface and Coatings Technology** **IF: 5.4**

Title: Improving bond strength and deposition efficiency of ceramic coatings via low pressure cold spraying: A study on hydroxyapatite coatings with Cu-Zn blends

Author: Behera A.K.; Mantry S.; Roy S.; Pati S.

Details: Volume 494, October 2024

Abstract: This study presents Low Pressure Cold Spraying (LPCS) method for ceramic coatings, aimed at enhancing efficiency and elucidating bonding mechanisms. It focuses on the deposition of ceramic coatings using LPCS, with hydroxyapatite (HA) on 316L stainless steel (SS) as an illustrative example. Despite the advantages of LPCS, retaining HA particles has proven challenging, resulting in thin coatings (11.09 ± 2.56 μm) with low bonding strength (1.80 ± 0.19 MPa). To address this issue, a composite coating strategy was developed by blending 20 wt% Cu and Zn powder with 80 wt% HA. This approach significantly improved coating properties, achieving enhanced bonding strength (33.70 ± 1.13 MPa), deposition efficiency (27 %), and hardness (136.30 ± 2.45 HV) compared to pure Cu-Zn coatings. Numerical simulations were conducted to interpret these experimental results, indicating that blending metal with HA improves deposition efficiency, bonding strength, and hardness. In HA coatings, particles fragment into submicron grains and embed into the substrate through mechanical interlocking (MI), with shockwave-induced bonding strengthening subsequent layers. For Cu-Zn coatings, bonding occurs through MI and adiabatic shear instability (ASI). In HA-Cu-Zn coatings, high-velocity HA particles and Zn particles enhance bonding further through in-situ tamping.

URL: https://www.sciencedirect.com/science/article/pii/S0257897224010612?via%3Dihub

SCHOLARLY PUBLICATIONS
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Journal Name: **Measurement: Journal of the International Measurement Confederation** **IF: 5.2**

Title: Experimental investigation of plain and nano-graphene oxide mixed dielectric for sustainable EDM of Nimonic alloy using Cu and Brass electrode: A comparative study

Author: Behera A.; Kumar Sahoo A.; Sankar Mahapatra S.

Details: Volume 23, Issue 1, December 2024

Abstract: The current research investigates the machinability of a novel Nimonic alloy through electro-discharge machining by assessing Material Removal Rate, Tool Wear Rate and Surface Roughness. The machining was conducted using plain dielectric and Graphene Oxide (GO) nanoparticles (5 g/l) mixed dielectric considering both Copper and Brass electrode. The novelity lies when machining with nano GO mixed dielectric. It was observed that the use of Copper electrode in machining of the alloy in nano GO mixed dielectric results in superior quality machining, demonstrating enhanced performance. The key findings include the identification of optimal parameters, where V_g of 70 V, T_{on} of 200 µs, F_p of 0.5 kgf/mm^2 maximize MRR (16.231 mm^3/min) and minimize TWR (0.0062 mm^3/min) and SR (5.1423 µm). The microstructural study of the machined surface and sustainability study along with the detailed comparative analysis of responses assures the superiority of machining in Nano GO mixed dielectric-Cu electrode environment.

URL: https://www.sciencedirect.com/science/article/pii/S0263224124015446?via%3Dihub

SCHOLARLY PUBLICATIONS
School of Mechanical Engineering
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Journal Name: Measurement: Journal of the International Measurement Confederation **IF: 5.2**

Title: Sustainable hard machining under zirconia nano-cutting fluid: A step towards a green and cleaner manufacturing process

Author: Khatai S., Sahoo A.K., Kumar R., Panda A.

Details: Volume 242, January 2025

Abstract: The present study deals with the machinability (flank wear, surface integrity, cutting temperature and power consumption) and sustainability (Carbon emission and noise emission) investigations during hard machining under dual nozzle assisted novel ZrO_2 based nano fluid MQL condition considering Taguchi L_{27} OA design of experiment. 0.3 % wt. ZrO_2 nanofluid MQL medium effectively reduce cutting temperature and found as 65 °C, which shows the effective cooling and lubrication properties of zirconia nanofluid. Improvement in surface quality has been observed with lower rate of flank wear. Depth of cut and feed are found to be the most influential factor affecting power consumption and carbon emission with contribution of 47.213 % and 60.861 % respectively. Noise emission mostly affected by the depth of cut with a contribution of 43.40 %. Optimal parametric condition yields d: 0.1 mm, f: 0.1 mm/rev and v: 80 m/min through WASPAS and sustainable towards manufacturing industries for cleaner hard machining.

URL: https://www.sciencedirect.com/science/article/pii/S0263224124019729?via%3Dihub

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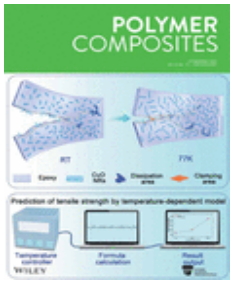
Journal Name: **Polymer Composites** **IF: 4.8**

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.



URL: https://4spepublications.onlinelibrary.wiley.com/doi/10.1002/pc.28880

SCHOLARLY PUBLICATIONS
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Journal Name: Chinese Journal of Physics **IF: 4.6**

Title: Experimental evaluation and artificial neural network modeling of heat transfer performance of aerosolized magnesium oxide nanoparticles flow through pipes

Author: Khadanga V., Mishra P.C., Mukherjee S., Ali N.

Details: Volume 92, December 2024

Abstract: This study presents a novel approach to modeling the convective heat transfer coefficient (CHTC) of aerosolized magnesium oxide (MgO) nanoparticles in a circular pipe using artificial neural network (ANN) technique, by leveraging experimental data. The work addresses a gap in existing research on the heat transfer characteristics of nanoaerosols under varying thermal and flow conditions. MgO nanoparticles (30-50 nm) were dispersed in compressed air at volume fractions of 0.005, 0.01, and 0.05 to generate the nanoaerosol. This aerosol was then driven through the pipe at volumetric flow rates between 10 and 50 liters per minute (lpm). The pipe was subjected to controlled heat fluxes of 4546.83 W/m², 9093.66 W/m², and 13640.49 W/m² to evaluate the aerosol heat transfer coefficient (AHTC). Experimental results demonstrated that incorporating MgO nanoparticles significantly enhanced the heat transfer coefficient by up to 1.4 %, 111 %, and 89.7 % at the specified heat flux values, corresponding to increases in the volumetric flow rate from 10 lpm to 50 lpm, respectively. An ANN-based correlation was developed to model the heat transfer coefficient in relation to heat flux, particle volume fraction, and volumetric flow rate. This model accurately predicted the experimental data, achieving a mean absolute percentage error (MAPE) of 9.9×10^{-5}, a mean square error (MSE) of 0.038433, and a coefficient of determination (R^2) of 0.99. These findings confirm the ANN model's efficacy in predicting the enhancement of the nanoaerosol heat transfer coefficient and provide a robust tool for future thermal management applications involving nanofluids.

URL: https://www.sciencedirect.com/science/article/abs/pii/S057790732400340X?via%3Dihub

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

SCHOLARLY PUBLICATIONS
School of Mechanical Engineering
KIIT Deemed to be University

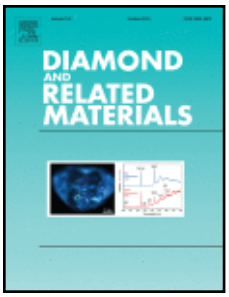
Journal Name: **Diamond and Related Materials** **IF: 4.3**

Title: Performance assessment of graphene oxide based nano-cutting fluids during sustainable hard turning through synthesis, characterization and machinability investigation

Author: Khatai S.; Sahoo A.K.; Kumar R.; Panda A.

Details: Volume 149, November 2024

Abstract: Achieving sustainability in manufacturing necessitates the implementation of eco-friendly solutions by adopting environmentally friendly coolants with cost-effective, energy-efficient and cleaner production processes without posing any risk to the operator's health. In this current work, mineral oil-based graphene oxide (GO) nano-cutting fluids of different concentration (0.05, 0.1, 0.2, 0.3, 0.4, 0.5 % wt.) are synthesized and their characteristics such as rheological, thermo-physical and tribological properties along with their stability and toxicology impact are thoroughly investigated. Further, the influence of nano-cutting fluid concentration on machinability and sustainability aspects during hard turning such as flank wear, surface integrity, power consumption, cutting temperature, carbon and noise emissions are investigated. According to the result an enhancement of 28.83 % and 29.54 % in viscosity and thermal conductivity have been recorded when concentration of nanofluid increases from 0.05 % to 0.5 %. GO nano-cutting fluids shows anti wear and friction reduction properties by providing excellent lubricious properties, as a result coefficient of friction has been reduced up to 28.36 % at 0.5 % wt. GO compared to plane mineral oil. A notable reduction in flank wear, cutting temperature, surface roughness, cutting temperature, power consumption, carbon emission and noise emission were noticed to be 25.96 %, 27.82 %, 23.86 %, 25.22 %, 11.66 % and 2.72 % respectively when the concentration of GO nanoparticles increases from 0.05 % to 0.5 % wt. Smoother surface with minimal defect has been noticed from the SEM and AFM image of machined workpiece at highest concentration (0.5 % wt.) of GO due to the synergetic effect of GO nano-cutting fluid and dual nozzle MQL system.



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