



SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

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Journal Name: Tribology International

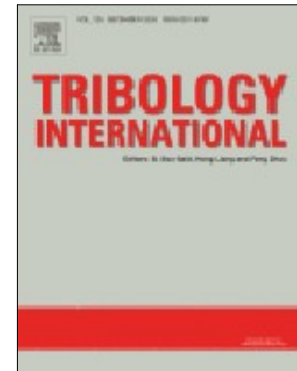
IF: 7.6

Title: Synergistic effect of SiC and MoS₂ on the tribological performance of Al-based composites

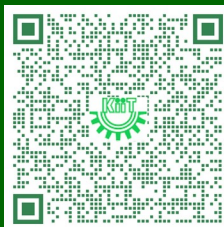
Author: Jha P.; Gautam R.K.S.; Tripathi V.M.; Kumar R.; Gupta G.; Ali S.

Details: Volume-224, December 2026

Abstract: This study investigates the friction and wear properties of aluminum (Al)-based composites, reinforced with a fixed amount of SiC (5 wt%) and varying amounts of MoS₂ (2, 4, and 6 wt%), and processed via powder metallurgy route. Microstructural examination has confirmed the formation of a dense, well-bonded structure consistent with the measured density and micro-hardness. The wear tests were conducted using a pin-on-disk test rig against EN31 steel under normal loads of 10, 20, and 30 N, with a constant sliding speed of 1 m/s. Among all the tested materials, the hybrid composite Al - SiC (5 wt%) - MoS₂ (2 wt%) demonstrated most superior tribological performance, exhibiting the lowest coefficient of friction (0.20) at 20 N and the lowest wear rate (2.24×10^{-4} mm³/m) at 10 N. FESEM analysis of the worn surfaces revealed that the dominant wear mechanism got transitioned from predominantly adhesive wear in pure Al to abrasive wear in the Al-SiC-MoS₂ composites. In the Al-SiC (5 wt%)-MoS₂ (6 wt%) composite, mild delamination was identified as the dominant wear mechanism under a relatively high load of 30 N. Furthermore, the wear tracks and surface morphology of the hybrid composite Al-SiC (5 wt%)-MoS₂ (2 wt%) exhibited the formation of a dense and compacted tribolayer. This layer consisted of an optimal content of MoS₂ acting as a solid lubricant, Al₂O₃ and MoO₃ forming a passivation layer, and SiC serving as a load-bearing constituent within the mechanically mixed layer, thereby reducing the coefficient of friction and wear rate.



URL: <https://www.sciencedirect.com/science/article/pii/S0301679X26006833?via%3Dihub>





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School of Mechanical Engineering

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Journal Name: Tribology International

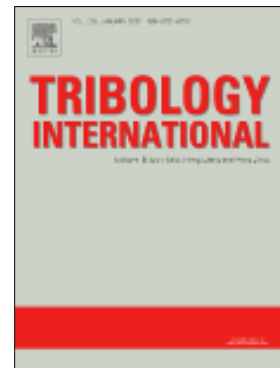
IF: 7.6

Title: Development of novel Al 7075/Fe-Cr/GO hybrid nanocomposites through stir-ultrasonication-squeeze cast process: Microstructure, mechanical and tribological properties and MQL assisted sustainable machinability investigation

Author: Sethy P.; Sahoo A.K.; Kumar R.; Panda A.; Das D.

Details: Volume-226, February 2027

Abstract: Integrating solid waste ferrochrome slag with graphene oxide reinforcements in Al7075 hybrid nanocomposites opens new avenues for the aerospace, marine, automobile applications. This study addresses the critical research gap by synthesizing, characterizing, and assessing the machinability of Al7075/Fe-Cr slag (5 wt%)/GO (0.5, 1, and 1.5 wt%) hybrid nanocomposites which have been fabricated through novel ultrasonic-stir-squeeze casting method and machined under sustainable dual-nozzle MQL environment. Microstructure analysis of 0.5 wt% GO shows a dendritic structure with fine, uniform grains, indicating significant grain refinement during solidification. This composition yielded improved mechanical and tribological properties with microhardness of 165 HV, an UTS of 226 MPa, an elongation of 8.17%, low wear coefficient of 0.098–0.2174, and coefficient of friction of 0.307–0.346 respectively. Machinability investigations revealed acceptable ranges of flank wear from 0.03 to 0.078 mm, surface roughness from 0.403 to 1.293 μm , temperature from 56.3 to 92.70C, power consumption from 0.334 to 0.507 kW, carbon and noise emission from 0.00412 to 0.02105 kgCO₂, and 74–78.9 dB respectively. Circularity and cylindricity remained well below 0.1 mm tolerance zone, producing saw tooth chips. The lowest tensile residual stress was observed for 1 wt% GO composite (181.06 MPa) post-machining due to the self-lubricating effect of GO paired with MQL. The optimal parameters are found to be w: 1.1061 wt%, v:76.1616 m/min, f: 0.05 mm/rev, and d: 0.1101 mm with composite desirability 0.9878. The synergistic effect of the inherent solid nano-lubricant layer from the GO, squeeze casting structure, and the MQL fluid film significantly improves overall manufacturing sustainability.



URL: <https://www.sciencedirect.com/science/article/pii/S0301679X26009552?via%3Dihub>





SCHOLARLY PUBLICATIONS

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Journal Name: Results in Surfaces and Interfaces

IF: 6.2

Title: Optimized microstructural, mechanical, and tribological properties of Ti-6Al-4V nanocomposites for next-generation dental implant applications

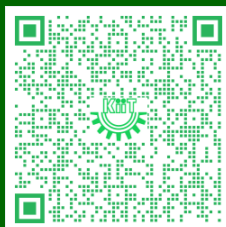
Author: Panda S.R.; Chakrabarty S.; Mishra P.C.; Munuswamy D.B.; Devarajan Y.; Raja T.; Jayabal R.; Mehar K.

Details: Volume 24, August 2026

Abstract: Ti-6Al-4V alloy is extensively used for biomedical and dental implant applications due to its outstanding biocompatibility, corrosion resistance and favorable mechanical strength. However, its limited wear resistance, and long-term stability necessitate further improvement. This study investigates the effects of TiO_2 , yttria-stabilized zirconia (YSZ), hydroxyapatite (HAp), and chitosan nanoparticles on the densification, microstructural features and mechanical/tribological behaviour of Ti-6Al-4V matrix nanocomposites. The nanocomposites were fabricated using powder metallurgy route followed by conventional sintering at 1500°C in a hydrogen atmosphere. Reinforcements were incorporated at 5, 10 and 20 wt % concentrations. FESEM and XRD analyses confirmed a homogeneous dispersion and strong interfacial bonding between nanoparticles and Ti matrix. The addition of reinforcements significantly enhanced densification behaviour, hardness, compressive strength, impact strength, and wear resistance compared with pure Ti-6Al-4V alloy. Nanocomposites containing 5 wt % reinforcement exhibited superior densification with reduced internal cracks and voids, indicating improved structural integrity. Increasing reinforcement content further contributed to superior mechanical and tribological performances. Based on the observed microstructural, mechanical, and tribological characteristics, and biomechanical requirements reported in the literature for stable dental implant materials, Ti+10 wt % TiO_2 , Ti+ 10 wt % YSZ, and Ti+ 10 wt % chitosan nanocomposites emerged as the most promising candidates for future dental implant applications. The study highlights the potential of nanoparticle-reinforced Ti-6Al-4V nanocomposites as advanced, durable and high-performance dental implant materials. Copyright.



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Journal Name: Journal of Field Robotics

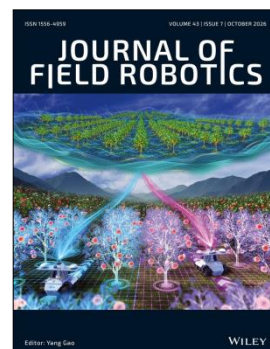
IF: 5.1

Title: Acoustic Microbots: Linking Fabrication Techniques to Acoustic Actuation Mechanisms-A Systematic Review

Author: Das S.; Venkatakrishnan K.; Pandey A.; Malik P.K.

Details: 24th August, 2026

Abstract: Acoustic fields are emerging as a promising wireless and tissue-penetrant power source for micro- and nanorobots, with propulsion efficiency, steering precision, and biocompatibility all critically linked to fabrication strategy. To clarify these interdependencies, we conducted a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-guided systematic review of literature from Scopus, Web of Science, PubMed, and IEEE Xplore (January 1, 2010–May 31 2025). Of 144 records, 63 primary studies and 22 secondary/background sources met predefined criteria and were synthesized. The evidence reveals five dominant actuation modes: boundary-driven streaming (~40%), bubble oscillation (~25%), acoustic radiation forces (~12%), whole-body resonance (~13%), and hybrid magneto-/chemo-acoustic mechanisms (~9%), each shaped by distinct fabrication approaches. Photolithography produces sharp fins for high-Re streaming; soft lithography forms gas-tight cavities for cavitation; two-photon and micro-DLP printing achieve nanometer-scale smoothness for radiation-pressure traps; and emerging multimaterial printers combine rigid acoustic chambers with magnetic or catalytic components. Three themes recur: (i) geometry–material–control co-design consistently outperforms sequential prototyping; (ii) scalability and biocompatibility remain major barriers, with ad hoc quality metrics; and (iii) inverse-design algorithms and closed-loop acoustic imaging are accelerating optimization. This review maps fabrication techniques to actuation demands and application contexts, offering a consolidated roadmap toward clinically and industrially viable acoustic microrobots.



URL: <https://onlinelibrary.wiley.com/doi/10.1002/rob.70342>





SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

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Journal Name: Scientific Reports

IF: 4.9

Title: Performance and surface integrity studies in electric discharge machining on Ti-6Al-4 V using neem oil dielectric and 3D Printed SS316L electrode

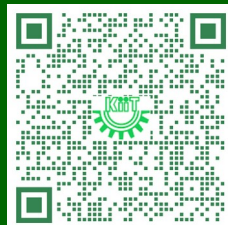
Author: Barik S.; Nanda B.K.; Mishra S.B.; Satpathy M.P.; Debebe S.T.

Details: Volume-16, Issue-1, December 2026

Abstract: Bio-dielectric fluids and advanced 3D printed electrodes are essential for sustainable, precise Electric Discharge Machining (EDM) of critical Ti-6Al-4 V aerospace components. In this study, neem biodiesel dielectric and a precisely manufactured 3D-printed stainless-steel electrode were used to identify optimal EDM parameters that maximize material removal rate (MRR) and minimize tool wear rate (TWR) and surface roughness (SR). The experiments were carried out using response surface methodology (RSM) with Box–Behnken design (BBD). Regression models showed high predictive accuracy ($R^2 > 0.98$). An integrated MEREC-CoCoSo multi-response optimization approach was subsequently applied to the experimental results to obtain the best output values. The results revealed the optimal setting as current (I_p) of 30 A, pulse-on time (T_{on}) of 0.3 s, and voltage gap (V_g) of 60 V. The interaction between T_{on} and V_g strongly influenced MRR, TWR, and SR. MRR first increased and then slightly decreased as V_g was raised from 60 V to 80 V. It also showed a marginal increase as T_{on} increased from 0.2 s to 0.4 s. In contrast, both TWR and SR increased sharply with higher V_g and longer T_{on} . Surface morphology analysis at the optimal setting showed fewer surface flaws, smaller craters, thinner recast layers, and lower porosity. Energy-dispersive X-ray spectroscopy (EDX) analysis confirmed the transfer of material from the 3D-printed electrode to the workpiece. This work provides a practical guide for industrial applications, demonstrating the feasibility and benefits of using novel electrode materials and eco-friendly dielectrics in sustainable EDM.

SCIENTIFIC
REPORTS

URL: <https://www.nature.com/articles/s41598-026-51103-y>





SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

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Journal Name: Scientific Reports

IF: 4.9

Title: Correlation of ultrasonic welding parameters with microstructural evolution and mechanical-electrical reliability of Al-CuNi joints for energy storage systems

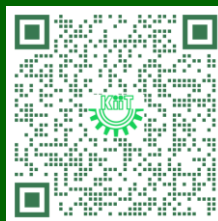
Author: Das S.; Routara B.C.; Nayak S.K.; Nanda B.K.; Mishra S.B.; Satpathy M.P.; Debebe S.T.

Details: Volume-16, Issue-1, December 2026

Abstract: In the automotive industry, ultrasonic welding (USW) stands out as a highly effective solid-state welding technique. It is specifically designed for joining components within lithium-ion battery modules and energy storage systems. To achieve an optimal weight-to-body ratio, dissimilar materials like aluminum, copper, and nickel are joined to reduce the weight of electrical and electronic devices. This study presents a systematic analysis of aluminum (Al) and cupro-nickel (CuNi) dissimilar joints using USW, with variations in welding parameters. The lap shear strength results show that sonotrode pressure and welding energy have a greater impact on joint strength than the amplitude of vibration at all tested levels. Joint strength reached peak values of 942 N and 236 N, respectively, before declining sharply as weld energy increased due to the high interfacial temperature. Resistance measurements revealed that resistance decreased with increasing welding energy. Additionally, Al-CuNi specimens exhibited higher hardness values at the faying surface compared to their base metals. A metallographic analysis of the weld cross-section was conducted to evaluate diffusion across the joint interface, supported by X-ray energy-dispersive spectroscopy, electron backscatter diffraction, and X-ray diffraction to assess weld quality.

SCIENTIFIC
REPORTS

URL: <https://www.nature.com/articles/s41598-026-57408-2>





SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

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Journal Name: Scientific Reports

IF: 4.9

Title: Exploring tribo-mechanical behavior of B₄C Reinforced LM25 aluminum matrix composites for structural applications

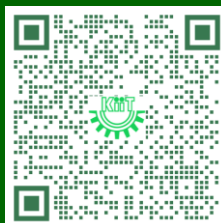
Author: Rao P.S.R.; Arunkumar D.T.; Pattanaik A.; Satpathy M.P.; Pati P.R.; Debebe S.T.

Details: Volume-16, Issue-1, December 2026

Abstract: This study reports a comprehensive evaluation of the impact on the mechanical and tribological properties of boron carbide (B₄C) particles reinforced with aluminum (LM25) metal matrix composites (MMCs). The synthesis of four different MMCs using the stir casting method and modifying 3, 6, and 9 wt% of 50 μ m B₄C particulates ensured the reliability of the results. Tensile strength and hardness increased with the rise in B₄C content. 9 wt% B₄C particulates to the LM25 matrix enhanced the hardness from 54.69 BHN to 68.54 BHN and increased the tensile strength from 198.48 MPa to 273.27 MPa. Various tribological (specific wear rate (SWR) and coefficient of friction (COF) characteristics were investigated. A novel hybrid metaheuristic sparrow search algorithm (SSA) was applied in the current study to provide the optimum process parameters and desired SWR and COF values of 2.102 mm³/Nm and 0.476, respectively. Scanning electron microscopy coupled with energy dispersive spectroscopy was used to assess the indigenously developed composites and understand the wear mechanism. The fabricated composites exhibited enhanced mechanical and tribological properties under specified experimental conditions, suggesting their suitability for further exploration in wear-resistant engineering applications.

SCIENTIFIC
REPORTS

URL: <https://www.nature.com/articles/s41598-026-56791-0>





SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

KIIT Deemed to be University

Journal Name: International Journal of Adhesion and Adhesives

IF: 4.0

Title: Adhesion and fracture behaviour of curved FRP composite single-lap joints using 1D and 2D functionally graded adhesives: A 3D finite element study

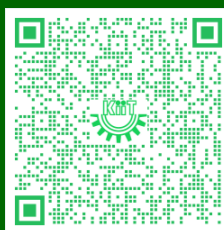
Author: Behera R.K.; Parida S.K.

Details: Volume 150, September 2026

Abstract: This paper presents Three-Dimensional (3-D) non-linear Finite Element (FE) analyses to assess the structural behaviour of curved laminated Fibre Reinforced Plastic (FRP) composite panel-based Single Lap Joints (SLJs) with Functionally Graded Adhesive (FGA) featuring pre-embedded adhesion failure. The principle of the fracture mechanics concept is used to investigate the behaviour of interfacial stresses (peel and shear stresses) along the adhesion failure fronts at critical locations. Corresponding three modes of Strain Energy Release Rates (SERRs) are considered as the damage growth parameters and are evaluated using Linear Elastic Fracture Mechanics (LEFM) based Virtual Crack Closure Technique (VCCT). One of the most significant benefits of FGAs over homogeneous adhesives is that the material properties change continuously in the desired direction from point to point, although these materials are microscopically inhomogeneous. FGA bonded joints have a continuous change in the adhesive properties throughout the bonded region, allowing for the homogeneity of stress distribution and load transmission to increase the load-carrying capacity. A series of numerical simulations has been performed using both unidirectional (1D) and bidirectional (2D) FGA gradation schemes to identify effective material grading profiles for reducing interfacial stresses and fracture driving forces. The optimum FGA configurations reduced the peak peel stress by up to 68.44%, the longitudinal shear stress by 41.18%, the transverse shear stress by 56.15%, and total SERR by 11.61% compared with the homogeneous adhesive. These results demonstrate the effectiveness of adhesive property gradation in mitigating adhesion failure, enhancing damage tolerance, and extending the service life of curved composite bonded joints.



URL: <https://www.sciencedirect.com/science/article/pii/S0143749626001302?via%3Dihub>





SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

KIIT Deemed to be University

Journal Name: Next Nanotechnology

IF: 3.7

Title: Nanostructured titanium composites in dental implantology: Design, structure-property relationships, biological safety and clinical translation

Author: Panda S.R.; Mishra P.C.; Kar A.K.

Details: Volume 10, December 2026

Abstract: Titanium and titanium alloys remain the dominant dental implant materials because of their strength, corrosion resistance and capacity for osseointegration. However, conventional titanium surfaces do not fully solve clinically relevant problems such as delayed integration in compromised bone, peri-implant infection, stress shielding, aesthetic grey shine-through, corrosion-assisted ion release and limited capacity for local drug delivery. Nanostructured titanium composites and nanocomposite coatings are therefore being developed to combine the mechanical reliability of titanium with nanoscale bioactivity, antibacterial function and controlled surface chemistry. This revised review addresses the specific gap left by earlier reviews: it classifies titanium-based nanocomposites by reinforcement chemistry and implant function, and connects nanoscale reinforcement size, morphology, dispersion and interfacial stability with mechanical, corrosion, osteogenic and antibacterial performance. Key aspects of ceramic, metallic, carbon-based, polymeric and bioactive and functionally graded (FG) titanium nanocomposites are critically analysed in terms of hydroxyapatite crystallinity, phase stability, coating adhesion as well as surface roughness, wettability, nano-topography and passive oxide-layer protection in oral environments. The quantitative findings of representative studies are summarized differentiating experimentally achieved performance gains from those proven clinically beneficial. It also reviewed the cytotoxicity and long-term risks of silver, nickel/cobalt, graphene derivatives, nanotubes and detached nanoparticles. While in vitro and animal studies support enhanced osteoblast response, corrosion protection and antibacterial activity, clinical evidence is thin, heterogeneous, and insufficient to confidently assert 3D-printed metal structures offer improved long-term implant survival - hydroxyapatite [HA]-coated or micro-rough titanium systems have well-established results. Next steps toward translation will require standardized assays, reproducible manufacturing, validated sterilization process and in vivo studies with proper power that would allow clinical trials.



URL: <https://www.sciencedirect.com/science/article/pii/S2949829526002287?via%3Dihub>

