



SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

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Journal Name: Tribology International

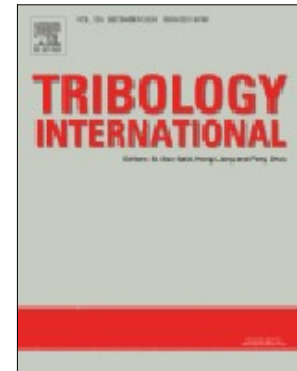
IF: 7.6

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

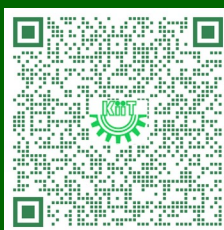
Author: Jha P.; Gautam R.K.S.; Tripathi V.M.; Kumar R.; Gupta G.; Ali S.

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>





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

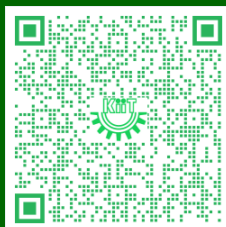
Author: Panda S.R.; Chakrabarty S.; Mishra P.C.; Munuswamy D.B.; Devarajan Y.; Raja T.; Jayabal R.; Mehar K.

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 TiO₂, 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 % TiO₂, 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.



URL: <https://www.sciencedirect.com/science/article/pii/S2666845926001613?via%3Dihub>





SCHOLARLY PUBLICATIONS

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Journal Name: IEEE Consumer Electronics Magazine

IF: 5.0

Title: Software Defined Networkâ€™Internet of Consumer Electronics for Intelligent Self-Powered Gas Sensor Monitoring

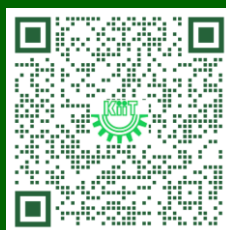
Author: Maity S.P.; Banerjee A.; Chakraborty C.; Singh S.

Details: Volume-15, Issue-4, July-2026

Abstract: Detection of harmful gases and their real-time monitoring in closed and open environments find applications such as safety in industrial settings, health monitoring, air quality tracking, etc. This article discusses the issue in the framework of an Internet of Consumer Electronics (IoCE). The model integrates Internet of Things (IoT)-based low-cost self-powered sensor deployment for gas sensing and software-defined network (SDN)-driven control, leading to SDN-IoCE. Reliable transmission of gas sensing data is essential and done through a reconfigurable intelligent surface-aided underlay cognitive radio network. Radio frequency energy harvesting is done for self-powering of sensor nodes. Two deep Q-networks are used, where the first one ensures seamless connectivity on gas sensing data transmission, while the other one performs its time-critical analysis. The proposed SDN-IoT architecture achieves 33-s- and 46-watt-lower values in delay/latency and energy consumption, respectively, over existing work.



URL: <https://ieeexplore.ieee.org/document/11229933>





SCHOLARLY PUBLICATIONS

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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

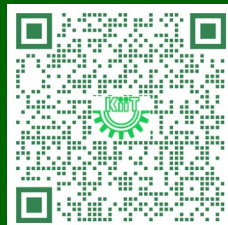
Author: Barik S.; Nanda B.K.; Mishra S.B.; Satpathy M.P.; Debebe S.T.

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

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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

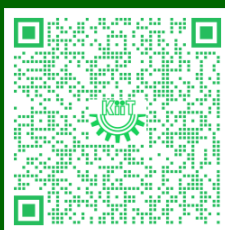
Author: Behera R.K.; Parida S.K.

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

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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>





SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

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Journal Name: Numerical Heat Transfer, Part B: Fundamentals

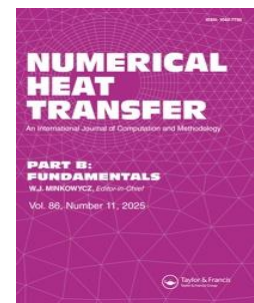
IF: 3.7

Title: Semi-analytical solution of influence of aspect ratio on heat transfer characteristic of flow of a Rivlin-Ericksen fluid of grade three through a rectangular channel

Author: Mohanty R.L.; Das M.; Mishra V.K.; Chaudhuri S.

Details: Volume-87, Issue-1, 25th July, 2026

Abstract: Effect of aspect ratio on thermal characteristics, including viscous dissipation, in pressure-driven flow of a third-grade fluid through a rectangular channel is considered. The walls of the channel are assumed to be maintained at uniform temperatures (the special case of the same upper and lower wall temperatures is also discussed). Earlier reported studies on heat transfer characteristics of third-grade fluids considered flow through large parallel plates. In actual case, however, flow occurs in channels and the parallel plate approximation results are only applicable near the central core of the channel, where, influence of the lateral walls are less. In view of this, in the present study, effect of the lateral walls are included in the governing equations and the results obtained are realistic from practical considerations. The effect of viscous dissipation is included in the energy conservation equation, and the influence of the aspect ratio is considered in the momentum and energy conservation equations. Momentum and energy conservation equations are formulated and reduced to their dimensionless forms by introducing suitable dimensionless variables and parameters. Entropy generation equation, including aspect ratio effect is deduced. The dimensionless governing equations are solved by applying the least square method (LSM), and the effects of parameters like aspect ratio, Brinkmann number, and non-Newtonian parameter on temperature, wall heat transfer, and velocity are examined. LSM is a semi-analytical technique which possesses a mixed characteristics of analytical and numerical methods and generates very accurate results. The results are validated with the results of least square homotopy perturbation method. It is important to note that heat transfer is reversed (from the upper wall to the surrounding cooling medium) at a distance of nearly 50% from the lateral walls) with rise in Brinkman number. In the region from lateral walls up to this limit (50% from the walls) heat is transferred from the upper wall to the flowing fluid. Results of the study can serve to be useful for design and analysis of heat exchangers in which lubricating oils, polymers flow takes place.



URL: <https://www.tandfonline.com/doi/full/10.1080/10407790.2025.2530682>





SCHOLARLY PUBLICATIONS

School of Mechanical Engineering

KIIT Deemed to be University

Journal Name: Metals

IF: 3.1

Title: Machining Performance of ZrO₂–GO-Reinforced A356 Hybrid Nanocomposite

Author: Mishra R.R.; Panda A.; Sahoo A.K.; Kumar R.

Details: Volume-16, Issue-7, July 2026

Abstract: This work examines the machining responses of dry turning in ultrasonic-assisted stir-squeeze cast A356 hybrid nanocomposites reinforced with zirconia (ZrO₂) and graphene oxide (GO). Accordingly, flank wear (VB_c) ranged from 0.061 to 0.238 mm, influenced by abrasion, adhesion, built-up edge (BUE) formation, and diffusion mechanisms. Cutting speed had the most significant effect on flank wear (65.65%), followed by depth of cut (18.2%) and feed rate (11.13%), supported by a well-fitted regression model ($R^2 = 0.987$; $p < 0.05$). Surface roughness (Ra) ranged from 1.733 to 7.012 μm , with cutting speed, feed rate, and depth of cut contributing 70.42%, 15.43%, and 9.56%, respectively. The cutting temperature was limited to 127 °C, primarily influenced by cutting speed (60.68%), whereas cutting power varied between 0.353 and 0.644 kW, mainly governed by cutting speed (68.71%) and depth of cut (25.92%). The chip morphology showed a segmented sawtooth pattern due to cyclic fracture initiation during material removal. Multi-criteria optimization using complex proportional assessment (COPRAS) identified $v = 90$ m/min, $f = 0.06$ mm/rev, and $d = 0.1$ mm as the optimal parameters, yielding a tool life of 22.6 min and a machining cost of INR 58.69 per item. This research is further focused on the implementation of different cooling lubrication techniques utilizing environmentally friendly cutting fluids, including Minimum-Quantity Lubrication and nano-MQL, among other types of environments.



URL: <https://www.mdpi.com/2075-4701/16/7/698>

