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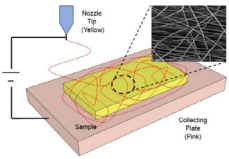
Content Highlights

DOI:10.3390/app11125565

Fabrication of a Simultaneous Highly Transparent and Highly Hydrophobic Fibrous Films

Authors: Doo-Hyeb Youn, Kyu-Sung Lee, Sun-Kyu Jung and Mangu Kang

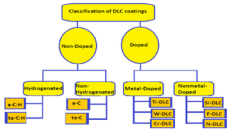


Abstract: This paper discusses the fabrication and characterization of electrospun nanofiber scaffolds made of polystyrene (PS). The scaffolds were characterized in terms of their basis material molecular weight, fiber diameter distribution, contact angles, contact angle hysteresis, and transmittance. We propose an aligned electrospun fiber scaffold using an alignment tool (alignment jig) for the fabrication of highly hydrophobic (θ_W > 125°) and highly transparent (T > 80.0%) films. We fabricated the alignment jig to align the electrospun fibers parallel to each other. The correlation between the water contact angles and surface roughness of the aligned electrospun fibers was investigated. We found that the water contact angle increased as the surface roughness was increased. Therefore, the hydrophobic properties of the aligned electrospun fibers were enhanced by increasing the surface roughness. With the change in the electrospinning mode to produce aligned fibers rather than randomly distributed fibers, the transmittance of the aligned electrospun fibers increased. The increase in the porous area, leading to better light transmittance in comparison to randomly distributed light scattering through the aligned electrospun fibers increased with the fibers. Through the above investigation of electrospinning parameters, we obtained the simultaneous transparent (>80%) and hydrophobic (θ_W > 140°) electrospun fiber scaffold. The aligned electrospun fibers of PS had a maximum transmittance of 91.8% at the electrospinning time of 10 s. The water contact angle (WCA) of the aligned electrospun fibers increased from 77° to 141° as the deposition time increased from 10 s to 40 s. The aligned fibers deposited at 40 s showed highly hydrophobic characteristics (θ_W > 140°).

DOI:10.3390/app11104445

Diamond-Like Carbon (DLC) Coatings: Classification, Properties, and Applications

Authors: Dipen Kumar Rajak, Ashwini Kumar, Ajit Behera and Pradeep L. Menezes

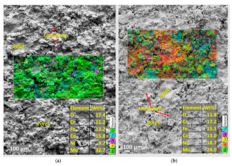


Abstract: DLC coatings have attracted an enormous amount of interest for science and engineering applications. DLC occurs in several different kinds of amorphous carbon materials. Owing to the extensive diversity in their properties, DLC coatings find applications in mechanical, civil, aerospace, automobile, biomedical, marine, and several other manufacturing industries. The coating life of DLC is predominately influenced by its constituent elements and manufacturing techniques. Numerous researchers have performed multiple experiments to achieve a robust understanding of DLC coatings and their inherent capabilities to enhance the life of components. In this review, a wide range of DLC coatings and their classification, properties, and applications are presented. Their remarkable performance in various applications has made DLC coatings a promising alternative over traditional solitary-coating approaches.

DOI:10.3390/app12063156

Microstructural Properties and Wear Resistance of Fe-Cr-Co-Ni-Mo-Based High Entropy Alloy Coatings Deposited with Different Coating Techniques

Authors: Gifty Oppong Boakye, Laura E. Geambazu, Arna M. Ormsdottir, Baldur G. Gunnarsson, Ioana Csaki, Francesco Fanicchia, Danyil Kovalov and Sigrun N. Karlsdottir

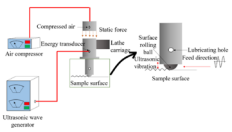


Astract: Materials can be subjected to severe wear and corrosion due to high temperature, high pressure and mechanical loads when used in components for the production of geothermal power. In an effort to increase the lifetime of these components and thus decrease cost due to maintenance High-Entropy Alloy Coatings (HEACs) were developed with different coating techniques for anti-wear properties. The microstructure, mechanical and tribological properties of CoCrFeNiMox (at% x = 20, 27) HEACs deposited by three different technologies—high-velocity oxygen fuel (HVOF), laser cladding (LC) and electro-spark deposition (ESD)—are presented in this study. The relationship between surface morphology and microstructural properties of the as-deposited coatings and their friction and wear behavior is assessed to evaluate their candidacy as coatings for the geothermal environment. The wear rates were lower for the HVOF coatings compared to LC and ESD-produced coatings. Similarly, a higher hardness (445 ± 51 HV) was observed for the HVOF HEACs. The mixed FCC, BCC structure and the extent of σ + μ nano precipitates are considered responsible for the increased hardness and improved tribological performance of the HEACs. The findings from the study are valuable for the development of wear-resistant HEAC for geothermal energy industry applications where high wear is encountered.

DOI:10.3390/app112210986

Ultrasonic Surface Rolling Process: Properties, Characterization, and Applications

Authors: Merbin John, Alessandro M. Ralls, Scott C. Dooley, Akhil Kishore Vellooridathil Thazhathidathil, Ashok Kumar Perka, Udaya Bhat Kuruveri and Pradeep L. Menezes

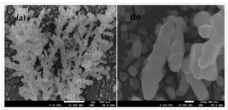


Abstact: Ultrasonic surface rolling process (USRP) is a novel surface severe plastic deformation (SPD) method that integrates ultrasonic impact peening (UIP) and deep rolling (DR) to enhance the surface integrity and surface mechanical properties of engineering materials. USRP can induce gradient nanostructured surface (GNS) layers on the substrate, providing superior mechanical properties, thus preventing premature material failure. Herein, a comprehensive overview of current-state-of-the art USRP is provided. More specifically, the effect of the USRP on a broad range of materials exclusively used for aerospace, automotive, nuclear, and chemical industries is explained. Furthermore, the effect of USRP on different mechanical properties, such as hardness, tensile, fatigue, wear resistance, residual stress, corrosion resistance, and surface roughness are summarized. In addition, the effect of USRP on grain refinement and the formation of gradient microstructure is discussed. Finally, this study elucidates the application and recent advances of the USRP process.

DOI:10.3390/app12105039

Ultrafast Detection of SARS-CoV-2 Spike Protein (S) and Receptor-Binding Domain (RBD) in Saliva Using Surface-Enhanced Raman Spectroscopy

Authors: Mohammed Ba Abdullah, Chahinez Dab, Mohammed Almalki, Abdullah Alnaim, Alaaedeen Abuzir and Chawki Awada



Abstract: Controlling contagious diseases necessitates using diagnostic techniques that can detect infection in the early stages. Although different diagnostic tools exist, there are still challenges related to accuracy, rapidity, cost-effectiveness, and ease of use. Surface-enhanced Raman spectroscopy (SERS) is a rapid, simple, less expensive, and accurate method. We continue our previous work published on SERS detection of the SARS-CoV-2 receptor-binding domain (RBD) in water. In this work, we replace water with saliva to detect SARS-CoV-2 proteins at very low concentrations and during a very short time. We prepared a very low concentration of 10^{-9} M SARS-CoV-2 spike protein (S) and SARS-CoV-2 receptor-binding domain (RBD) in saliva to mimic a real case scenario. Then, we drop them on a SERS substrate. Using modified SERS measurements on the control and the sample containing the biomolecules, confirmed the sensitivity of the target identification. This technique provides different diagnostic solutions that are fast, simple, non-destructive and ultrasensitive. Simulation of the real-world of silicon wire covered with silver and gold, were performed using an effective and accurate tool, COMSOL Multiphysics software, for the enhancement properties study.

Topical Collection in Section

Organic Corrosion Inhibitors and Protective Coatings
Guest Editor: Dr. Ioannis Kartsonakis

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