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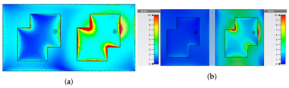
Featured Papers

DOI:10.3390/app12031068

Designed Circularly Polarized Two-Port Microstrip MIMO Antenna for WLAN Applications

Authors: Ijaz Khan, Qun Wu, Inam Ullah, Saeed Ur Rahman, Habib Ullah and Kuang Zhang

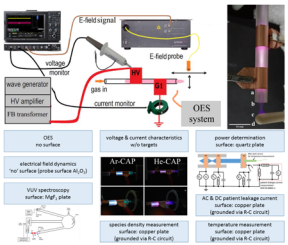


Abstract: The proposed work describes a corner square-cut square-patch multiple-input multiple-output (MIMO) antenna with reduced mutual coupling for circular polarization (CP). A two-port MIMO-CP antenna was designed and operated at 5.6 GHz for wireless local area network (WLAN) applications. The dimensions of the MIMO-CP antenna were 22.5×50mm^2 (0.43λ_0×0.933λ_0) and the FR4 substrate height was 1.6 mm. Between the two-elements, the edge-to-edge distance was 12.2 mm (0.227 λ_0), where λ_0 was the free space wavelength at 5.6 GHz. A slot was created in the middle of the ground in the proposed MIMO antenna to reduce mutual coupling and improve CP. The ground slot improves impedance matching and provides a better S-parameter and axial ratio (AR), according to the antenna results. According to the simulated results, the proposed antenna bandwidth of 5.23–6.42 GHz (21.4%) for S11 were <−10 dB, isolation was −37 dB with a peak gain of 6 dB and AR ≤3 dB from 5.37 to 5.72 GHz (6.25%). The proposed antennas are simple to fabricate, have low profiles, are inexpensive, have good isolation, and are CP. The diversity gain (DG) and envelop correlation coefficient (ECC) results are better in the simulated frequency band. A MIMO-CP antenna geometry prototype is built and measured for comparison, yielding good results when compared to the simulated and measured results. The MIMO-CP antenna, as designed, is suitable for WLAN applications.

DOI:10.3390/app12020644

Cold Atmospheric Pressure Plasma Jet Operated in Ar and He: From Basic Plasma Properties to Vacuum Ultraviolet, Electric Field and Safety Thresholds Measurements in Plasma Medicine

Authors: Nastuta, Andrei Vasile and Torsten Gerling



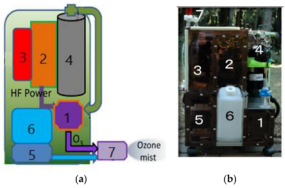
Abstract: Application desired functionality as well as operation expenses of cold atmospheric pressure plasma (CAP) devices scale with properties like gas selection. The present contribution provides a comparative investigation for a CAP system operated in argon or helium at different operation voltages and distance to the surface. Comparison of power dissipation, electrical field strength and optical emission spectroscopy from vacuum ultraviolet over visible up to near infrared ((V)UV-VIS-NIR) spectral range is carried out. This study is extended to safety relevant investigation of patient leakage current, induced surface temperature and species density for ozone (O_3) and nitrogen oxides (NO_χ). It is found that in identical operation conditions (applied voltage, distance to surface and gas flow rate) the dissipated plasma power is about equal (up to 10 W), but the electrical field strength differs, having peak values of 320 kV/m for Ar and up to 300 kV/m for He. However, only for Ar CAP could we measure O_3 up to 2 ppm and NO_χ up to 7 ppm. The surface temperature and leakage values of both systems showed different slopes, with the biggest surprise being a constant leakage current over distance for argon. These findings may open a new direction in the plasma source development for Plasma Medicine.

DOI:10.3390/app12094405

Applications of Plasma Produced with Electrical Discharges in Gases for Agriculture and Biomedicine

Auhtors: Stryczewska, Henryka Danuta and Oleksandr Boiko

Abstract: The use of thermal and non-thermal atmospheric pressure plasma to solve problems related to agriculture and biomedicine is the focus of this paper. Plasma in thermal equilibrium is used where heat is required. In agriculture, it is used to treat soil and land contaminated by the products of biomass, plastics, post-hospital and pharmaceutical waste combustion, and also by ecological phenomena that have recently been observed, such as droughts, floods and storms, leading to environmental pollution. In biomedical applications, thermal plasma is used in so-called indirect living tissue treatment. The sources of thermal plasma are arcs, plasma torches and microwave plasma reactors. In turn, atmospheric pressure cold (non-thermal) plasma is applied in agriculture and biomedicine where heat adversely affects technological processes. The thermodynamic imbalance of cold plasma makes it suitable for organic syntheses due its low power requirements and the possibility of conducting chemical reactions in gas at relatively low and close to ambient temperatures. It is also suitable in the treatment of living tissues and sterilisation of medical instruments made of materials that are non-resistant to high temperatures. Non-thermal and non-equilibrium discharges at atmospheric pressure that include dielectric barrier discharges (DBDs) and atmospheric pressure plasma jets (APPJs), as well as gliding arc (GAD), can be the source of cold plasma. This paper presents an overview of agriculture and soil protection problems and biomedical and health protection problems that can be solved with the aid of plasma produced with electrical discharges. In particular, agricultural processes related to water, sewage purification with ozone and with advanced oxidation processes, as well as those related to contaminated soil treatment and pest control, are presented. Among the biomedical applications of cold plasma, its antibacterial activity, wound healing, cancer treatment and dental problems are briefly discussed.

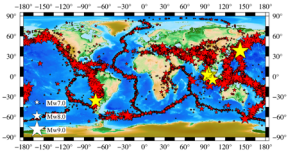


DOI:10.3390/app12157496

Natural Time Analysis of Global Seismicity

Authors: Christopoulos, Stavros-Richard G., Panayiotis K. Varotsos, Jennifer Perez-Oregon, Konstantina A. Papadopoulou, Efthimios S. Skordas and Nicholas V. Sarlis

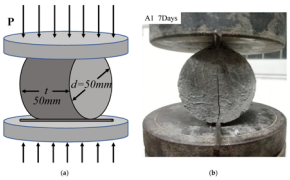
Abstract: Natural time analysis enables the introduction of an order parameter for seismicity, which is just the variance of natural time χ, $\kappa_1 = \langle\chi^2\rangle - \langle\chi\rangle^2$. During the last years, there has been significant progress in the natural time analysis of seismicity. Milestones in this progress are the identification of clearly distiguishable minima of the fluctuations of the order parameter κ_1 of seismicity both in the regional and global scale, the emergence of an interrelation between the time correlations of the earthquake (EQ) magnitude time series and these minima, and the introduction by Turcotte, Rundle and coworkers of EQ nowcasting. Here, we apply all these recent advances in the global seismicity by employing the Global Centroid Moment Tensor (GCMT) catalog. We show that the combination of the above three milestones may provide useful precursory information for the time of occurrence and epicenter location of strong EQs with $M \geq 8.5$ in GCMT. This can be achieved with high statistical significance (p-values of the order of 10−5), while the epicentral areas lie within a region covering only 4% of that investigated.



DOI:10.3390/app12010526

Effect of Rice Straw on Tensile Properties of Tailings Cemented Paste Backfill

Authors: Li, Zeyu, Xiuzhi Shi and Xin Chen



Abstract: It is important and difficult to improve the tensile strength of backfill material to ensure the stability of goafs. In this study, rice straw (RS) in fiber form is used to improve the tensile properties of cemented paste backfill (CPB). An orthogonal experiment was designed, Brazilian indirect tensile strength tests were conducted to test the tensile performance of RS fiber-reinforced cemented paste backfill (RSCPB) under different fiber content (1, 2, 3 kg/m3) and fiber length (0.8~1, 1~3, 3~5 cm), and the microstructure of RSCPB was analyzed with scanning electron microscopy (SEM). The results showed that, compared with the conventional cemented paste backfill (CCPB), the increase in tensile strength of RSCPB ranged from 115.38% to 300.00% at 3 days curing age, 40.91% to 346.15% at 7 days, and −38.10% to 28.00% at 28 days, and the strain was slightly reduced during the curing period. The tensile strength, strain, and percentage increase of the RSCPB compared to the CCBP did not show a monotonic pattern of variation with the RS fiber content and length during the curing period. The RSCPB samples fractured under peak stress, showing obvious brittle failure. In addition, sulfate generated from S2− in the tailings inhibits the hydration reaction, and generates swelling products that form weak structural surfaces, which, in turn, lead to a 28-day tensile strength and strain of RSCPB lower than those at 7 days.

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