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Editorial

Plasmas Processes Applied on Metals and Alloys

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1. Introduction and Scope

Plasma technology has been extensively used for many applications, such as plasma etching, thin-film deposition, and surface modification. A low-pressure plasma is easier to generate, more stable, and operated in a cleaner vacuum environment; therefore, it finds widespread use in industry. Atmospheric-pressure plasma is operated at a regular pressure without using vacuum chambers and pumps; this could lower cost, reduce maintenance effort, and enable easier integration into a reel-to-reel manufacturing process. Recently, many research and development groups have, therefore, focused on atmospheric-pressure plasma technology.

This Special Issue focuses on recent advances in plasma technology and its application to metals, alloys, and related materials; surface modification, material syntheses, cutting and surface coatings are performed using low-pressure plasma or atmospheric-pressure plasma.

2. Contributions

Nine research contributions are published in this Special Issue. The application of low-temperature air-plasma treatment on an organic-inorganic halide perovskite film was investigated using diffuse coplanar surface barrier discharge (DCSBD) at 70 °C [1]. An aluminum surface was treated and the wettability distribution was experimentally investigated using an atmospheric-pressure remote plasma [2]. Spark plasma sintering and a selective laser melting technique were used in combination to fabricate TiO_2/Ag ceramics and Ti_6Al_4V-TiO_2/Ag composites. This technique provides a feasible route to add ceramic reinforcement to 3D printed metals and alloys [3]. An atmospheric-pressure pulsed-arc plasma jet was used for the nitridation of steel. A nitrogen/hydrogen mixed gas was used and the nitrogen dose was successfully controlled [4]. A self-lubricating plasma electrolytic oxidation-polytetrafluoroethylene (PEO-PTFE) composite was coated on pure titanium. The PEO-PTFE deposited by this method shows excellent tribological properties with a low friction coefficient and wear rate [5]. A DC-pulse atmospheric-pressure plasma jet (APPJ) was used for rapidly synthesizing Pt-SnO_x nanomaterials that were then used as the counter electrodes of dye-sensitized solar cells (DSSCs). The DSSC performance can be significantly improved with only 5 s APPJ processing. The DC-pulse APPJ was demonstrated to be an efficient tool for the rapid synthesis of Pt-SnO_x nanomaterials [6]. The mechanical and microstructural features of plasma-cut steel were investigated. Further, the mechanical properties, microstructure, hardness, and residual stresses were compared and discussed [7]. The crystal structures of GaN nanodots produced by nitrogen plasma treatment on Ga metal droplets were investigated. The formation of a thin SiN_x layer could inhibit the phase transformation of GaN nanodots from a zinc-blende phase to a wurtzite phase [8]. Al_2O_3 coatings were prepared on Ti-45Al-8.5Nb alloys via cathodic plasma electrolysis deposition. The results suggested that the solution surface tension influences the average diameter of the hydrogen bubbles formed on the cathode surface during this process [9].

3. Conclusions and Outlook

The contributions of this Special Issue include a wide scope of plasma technologies applied to materials. Plasma is a versatile tool that can be applied in many types of material processing. New materials processing applications of plasmas and new plasma technologies are still being developed rapidly. As Guest Editors, we hope that this Special Issue can contribute new knowledge to the plasma materials research society.

Conflicts of Interest: The authors declare no conflict of interest.

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