coatings

Editorial

Special Issue: Plasma Electrolytic Oxidation (PEO) Coatings

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The demand of modern technological society for light structural materials (Al, Ti, Mg) emphasizes a combination of good corrosion resistance with wear properties and functionalized surfaces. Their extensive field of applications ranges from mechanical aspects and transport components to bioengineering. Regardless of the final application, improved tailored surfaces are required to prolong service life and reduce long-term costs.

Plasma Electrolytic Oxidation (PEO) is an exceptional candidate to achieve that goal: it enables a considerable improvement of the mechanical properties and corrosion resistance of light alloys, together with other characteristics such as improved biocompatibility. PEO is an environmentally friendly treatment process employed to produce relatively thick (10–100 µm) ceramic-like coatings on Mg, Al, Ti, and other valve metals, with incorporation of species from both the substrate and the electrolyte.

The coatings are formed under high voltages, exceeding those of dielectric breakdown, when short-lived discharges occur locally on the coating surface and the current density and temperature are greatly increased, facilitating the formation of phases normally associated with processing at relatively high temperatures.

The present special issue covers a wide range of information of PEO-coated light alloys for structural (Al, Mg) and biomedical applications (Ti, Mg) with 10 research papers and 1 review.

The review published by Simchen et al. [1] summarizes the main aspects of Plasma Electrolytic Oxidation Technique with special focus on the process kinetics and the influence of the process parameters on the process, and, thus, on the resulting coating properties, e.g., morphology and composition.

Regarding PEO on Mg alloys, three papers have been published covering biomedical aspects [2,3] and corrosion and wear performance [4]. It is reported by Jian et al. [2] the investigation of the corrosion resistance and cytocompatibility of a bioactive micro-arc oxidation coating on AZ31 Mg alloy including in vitro and vivo tests. A study covering new biocompatible Mg alloys–Al free is reported by Moreno et al. [3] focused on the degradation behaviour of Mg0.6Ca and Mg0.6Ca2Ag alloys with bioactive Plasma Electrolytic Oxidation coatings. In the case of applications of PEO coated Mg alloys for the transport industry, the research conducted by Lu et al. [4] covers the influence of SiO_2 particles on the corrosion and wear resistance of Plasma Electrolytic Oxidation-Coated AM50 Mg alloy.

Different aspects of PEO coated Ti alloys are analyzed in 3 works [5–7]. For instance, the study reported by Kozelskaya [5] is related to biomedical applications with special interest in the development of porous CaP coatings formed by combination of Plasma Electrolytic Oxidation and RF-Magnetron sputtering. Another research associated with biomedical features is published by Durdu [6] focused on the characterization, bioactivity and antibacterial properties of copper-based TiO_2 bioceramic coatings.

Another aspect reported by Engelkamp [7] is the influence of mixtures electrolytes H_2SO_4-H_3PO_4 on galvanostatically controlled Plasma Electrolytic Oxidation.

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In the case of PEO coated Al alloys 4 works are dedicated to cover different features [8–11]. The research published by del Olmo et al. [8] investigates environmentally friendly alternatives to toxic Cr (VI)-based surface treatments for corrosion protection of Al alloys focused on multifunctional PEO-layered double hydroxides (LDH) coatings. Another work related to corrosion protection is the one published by Lou et al. [9] showing information about the correlation between defect density and corrosion parameter of electrochemically oxidized aluminum. Moving to other properties, the production of phosphorescent coatings is reported by Auzins [10] using Sr0.95Eu0.02Dy0.03Al2O4-δ powder and Plasma Electrolytic Oxidation. In addition, Sobolev et al. [11] investigates the use of molten salt during the development of PEO coatings on AA7075 from the point of view of fabrication and characterization.

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References

1. Simchen, F.; Sieber, M.; Kopp, A.; Lampke, T. Introduction to plasma electrolytic oxidation—An overview of the process and applications. *Coatings* **2020**, *10*, 628. [CrossRef]
2. Jian, S.-Y.; Ho, M.-L.; Shih, B.-C.; Wang, Y.-J.; Weng, L.-W.; Wang, M.-W.; Tseng, C.-C. Evaluation of the corrosion resistance and cytocompatibility of a bioactive micro-arc oxidation Coating on AZ31 Mg alloy. *Coatings* **2019**, *9*, 396. [CrossRef]
3. Moreno, L.; Mohedano, M.; Mingo, B.; Arrabal, R.; Matykina, E. Degradation Behaviour of Mg0.6Ca and Mg0.6Ca2Ag Alloys with Bioactive Plasma Electrolytic Oxidation Coatings. *Coatings* **2019**, *9*, 383. [CrossRef]
4. Lu, X.; Chen, Y.; Blawert, C.; Li, Y.; Zhang, T.; Wang, F.; Kainer, K.U.; Zheludkevich, M. Influence of SiO_2 particles on the corrosion and wear resistance of plasma electrolytic oxidation-coated AM50 Mg alloy. *Coatings* **2018**, *8*, 306. [CrossRef]
5. Kozelskaya, A.; Dubinenko, G.; Vorobyev, A.; Fedotkin, A.; Korotchenko, N.; Gigilev, A.; Shesterikov, E.; Zhukov, Y.; Tverdokhlebov, S. Porous cap coatings formed by combination of plasma electrolytic oxidation and RF-magnetron sputtering. *Coatings* **2020**, *10*, 1113. [CrossRef]
6. Durdu, S. Characterization, bioactivity and antibacterial properties of copper-based TiO_2 bioceramic coatings fabricated on titanium. *Coatings* **2019**, *9*, 1. [CrossRef]
7. Engelkamp, B.; Fischer, B.; Schierbaum, K. Plasma Electrolytic Oxidation of Titanium in H_2SO_4–H_3PO_4 Mixtures. *Coatings* **2020**, *10*, 116. [CrossRef]
8. Del Olmo, R.; Mohedano, M.; Mingo, B.; Arrabal, R.; Matykina, E. LDH Post-Treatment of Flash PEO Coatings. *Coatings* **2019**, *9*, 354. [CrossRef]
9. Lou, H.-R.; Tsai, D.-S.; Chou, C.-C. Correlation between Defect Density and Corrosion Parameter of Electrochemically Oxidized Aluminum. *Coatings* **2020**, *10*, 20. [CrossRef]
10. Auzins, K.; Zolotarjovs, A.; Bite, I.; Laganovska, K.; Vitola, V.; Smits, K.; Millers, D. Production of Phosphorescent Coatings on 6082 Aluminum Using $Sr_{0.95}Eu_{0.02}Dy_{0.03}Al_2O_{4\text{-}\delta}$ Powder and Plasma Electrolytic Oxidation. *Coatings* **2019**, *9*, 865. [CrossRef]
11. Sobolev, A.; Peretz, T.; Borodianskiy, K. Fabrication and Characterization of Ceramic Coating on Al7075 Alloy by Plasma Electrolytic Oxidation in Molten Salt. *Coatings* **2020**, *10*, 993. [CrossRef]