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Editorial

Innovative Coatings for Materials Subjected to Aggressive Environments

Argelia Fabiola Miranda Pérez

Department of Strategic Planning and Technology Management, Universidad Popular Autónoma del Estado de Puebla, 21 sur 1103 Barrio Santiago, Puebla 72410, Mexico; argeliafabiola.miranda@upaep.mx

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Aggressive environments require durable materials or excellent coatings to improve their performance and life service [1]. In the oil and gas industry, much of the catastrophic damage is mainly due to the poor selection of materials for conduction, storage, or transformation, or to ignorance of the deterioration process of these materials when they are subjected to corrosive environments.

While the inadequate selection of materials is due to the lack of preparation and training of those who make decisions to purchase equipment and materials, operational failures are due to inadequate maintenance and ignorance of how materials behave under corrosive conditions. In order to improve equipment performance one alternative is the employment of innovative coatings that are resistant to corrosive environments. Stainless steels are suitable materials that are used in offshore environments, and different surface engineering methods have been developed for their use, including surface treatments and coating deposition, with both processes gaining popularity. Several surface modifications that can be applied to stainless steels have been proposed; for instance, films employed for coatings can serve as effective protection for stainless steels, as studied in [2–4], were ZrO_2 films provided good resistance in unfavorable environments and avoided segregation and hot cracking during high temperature operations. Ni-Co, Ni-Cr, Ta, and Cd coatings for tribocorrosion, where techniques such as thermal spraying, physical, galvanic and chemical depositions, or plasma electrolytic/micro-arc oxidation (PEO/MAO) [5–7] are being developed for better performance in stationary corrosion conditions. Some other efforts are focused on the protection of steels in compounds or during their natural oxidation, as in [8]. Traditional thermal processes to improve stainless steel surfaces are widely employed, but the innovation of these processes is thoroughly investigated in [9], where microstructural modification improved the wear resistance of the studied steels and maintained corrosion resistance.

These innovative engineering techniques are generally qualitative in nature, and based on their applications, it is important to predict the remaining lifetime of the components when they are applied.

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References

1. Kuptsov, K.A.; Antonyuk, M.N.; Bondarev, A.V.; Sheveyko, A.N.; Shtansky, D.V. Electrospark deposition of wear and corrosion resistant Ta(Zr)C-(Fe,Mo,Ni) coatings to protect stainless steel from tribocorrosion in seawater. *Wear* **2021**, *486–487*, 204094. [CrossRef]
2. Yu, J.; Ji, G.; Liu, Q.; Zhang, J.; Shi, Z. Effect of sol-gel ZrO_2 films on corrosion behavior of the 304 stainless steel in coal-gases environment at high temperature. *Surf. Coat. Technol.* **2017**, *331*, 21–26. [CrossRef]
3. Beer, S.M.J.; Samelor, D.; Aal, A.A.; Etzkorn, J.; Rogalla, D.; Turgambaeva, A.E.; Esvan, J.; Kostka, A.; Vahlas, C.; Devi, A. Direct liquid injection chemical vapor deposition of ZrO_2 films from a heteroleptic Zr precursor: Interplay between film characteristics and corrosion protection of stainless steel. *J. Mater. Res. Technol.* **2021**, *13*, 1599–1614. [CrossRef]
4. Avramova, I.; Stoychev, D.; Marinova, T. Characterization of a thin CeO_2–ZrO_2–Y_2O_3 films electrochemical deposited on stainless steel. *Appl. Surf. Sci.* **2006**, *253*, 1365–1370. [CrossRef]
5. Wood, R.J.K.; Wharton, J.A. Coatings for tribocorrosion protection. In *Tribocorrosion of Passive Metals and Coatings*; Landolt, S.M.D., Ed.; Woodhead Publishing: Sawston, UK, 2011; pp. 296–333.
6. Yuan, J.; Wang, J.; Gao, Y.; Mao, J.; Hu, W. Preparation and magnetic properties of Ni-Co-P-Ce coating by electroless plating on silicon substrate. *Thin Solid Films* **2017**, *632*, 1–9. [CrossRef]
7. Mosayebi, S.; Rezaei, M.; Mahidashti, Z. Comparing corrosion behavior of Ni and Ni-Mo electroplated coatings in chloride mediums. *Colloids Surf. A Physicochem. Eng. Asp.* **2020**, *594*, 124654. [CrossRef]
8. Vogt, J.-B.; Serre, I.P. A Review of the Surface Modifications for Corrosion Mitigation of Steels in Lead and LBE. *Coatings* **2021**, *11*, 53. [CrossRef]
9. Adachi, S.; Egawa, M.; Yamaguchi, T.; Ueda, N. Low-Temperature Plasma Nitriding for Austenitic Stainless Steel Layers with Various Nickel Contents Fabricated via Direct Laser Metal Deposition. *Coatings* **2020**, *10*, 365. [CrossRef]