

Electrochemical properties of ZrN coated on stainless steel was evaluated by potentiodynamic polarization and EIS test in 3.5% NaCl, 0.1N HCl and 11pH Na₂SO₄. Compared to stainless steel, coated samples show better corrosion resistance in all the cases. The corrosion resistance of thin film not only depends on composition and thickness but also on environment to which it is subjected to. As stated by Ellina Lunarska et al [15], it could be concluded that chloride ions are more aggressive than sulfate ions for stainless steel. It can be said that the presence of chloride ions in the solution affects the passivity of stainless steel substrate more negatively than that of sulfate ions. The effect of chloride ion is more aggressive in HCl compared to NaCl as the bonding in HCl is ionic and hence even when small potential is applied, its dissociation occurs whereas that in case of NaCl bonding is covalent resulting in better stability. However evolution of hydrogen decreases the inhomogeneity in the corrosion behavior depicted by difference in E_{corr} values of coating and substrate in 3.5% NaCl, 11pH Na₂SO₄ and 0.1N HCl.[16]

5. References

- [1] J. M. Rigsber, D. M. Leet, J. C. Logas, V. f. hock, B.L. Cain and D. G. Teer , “Ion Plating and the Production of Cu-Cr Alloy Coatings”, *Surface Engineering: surface modification of materials*, Vol. 85, pp. 602-613.
- [2] T. Burakowski, and T. Wierzchon, “Surface Engineering of Metals, principles, Equipment, Technologies”, *CRC press Engineering: surface modification of materials*, pp. 10-12, 1998.
- [3] H.Dong, Y.Sun and T. Bell ,”Enhanced corrosion resistance of duplex coatings”, *Surface and Coating technology*, vol. 90, pp. 91-101, 1997.
- [4] C. Pfohl, K. T. Rie, M. K. Hirschfeld, and J. W. Schultze, “Evaluation of the corrosion behaviour of wear-resistant PACVD coatings”, *Surface and Coating Technology*, vol.112, pp. 114–117, 1999.
- [5] J. H. Huang, H. C. Yang, X. J. Guo, and G. P. Yu , “Effect of film thickness on the structure and properties of nanocrystalline ZrN thin films produced by ion plating”, *Surface & Coatings Technology*, vol. 195, pp. 204– 213, 2005.
- [6] D. V. Tzaneva, V. I. Dimitrova, and P. E Hovsepyan, “Influence of the formation conditions of TiN coatings on their electrochemical behaviour in sulphuric acid and sodium chloride solutions”, *Thin Solid Films*, vol. 295, pp. 178-184, 1997.
- [7] L. Li, E. Niu, G. Lv, X. Zhang, H. Chen, S. Fan, C. Liu, and S. Yang, “Synthesis and electrochemical characteristics of Ta–N thin films fabricated by cathodic arc deposition”, *Applied Surface Science*, vol. 253, pp. 6811–6816, 2007.
- [8] M. Flores, O. Blanco, S. Muhl, C. Piña and J. Heiras, “Corrosion of a Zn–Al–Cu alloy coated with TiN/Ti films”, *Surface and Coatings Technology*, vol. 10, pp. 449-453, 1998.
- [9] M. L. Zheludkevich, K. A. Yasakau, A. C. Bastos, O. V. Karavai, and M. G. S. Ferreira, “On the application of electrochemical impedance spectroscopy to study the self-healing properties of protective coatings”, *Electrochemistry Communications*, vol. 9, pp. 2622–2628, 2007.
- [10] H. Altun and S. Sen, “The effect of PVD coatings on the corrosion behaviour of AZ91 magnesium alloy”, *Materials & Design*, Vol. 27, pp. 1174-1179, 2006.
- [11] F. Hollsteina, R. Wiedemann, and J. Scholz, “Characteristics of PVD-coatings on AZ31hp magnesium alloys”, *Surface and Coatings Technology*, vol. 162, pp. 261–268, 2003.
- [12] J. H. Huang, F.Y. Ouyang, and G. P. Yu, “Effect of film thickness and Ti interlayer on the structure and properties of nanocrystalline TiN thin films on AISI D2 steel”, *Surface & Coatings Technology*, vol. 201, pp.7043–7053, 2007.
- [13] W. J. Chou, G. P. Yu, and J. Huang, “Corrosion resistance of ZrN films on AISI 304 stainless steel substrate”, *Surface and Coatings Technology*, Vol. 167, pp. 59-67, 2003.
- [14] L. Li, E. Niu, G. Lv, X. Zhang, H. Chen, S. Fan, C. Liu, and S. Yang, “Synthesis and electrochemical characteristics of Ta–N thin films fabricated by cathodic arc deposition”, *Applied Surface Science*, vol. 253, pp.6811–6816, 2007
- [15] E. Lunarska, N. Ageeva, and J. Michalski, “Corrosion resistance of plasma-assisted chemical vapour deposition (PACVD) TiN-coated steel in a range of aggressive environments”, *Surface and Coatings technology*, Vol. 85, pp. 125-130, 1996.
- [16] M. A. M. Ibrahim, S. F. Korabloy, and M. Yoshimura, “Corrosion of stainless steel coated with TiN,(TiAl)N and CrN in aqueous environment”, *Corrosion science*, pp. 815-822, 2002.