Investigation Nano coating for Corrosion Protection of Petroleum Pipeline Steel Type A106 Grade B; Theoretical and Practical Study in Iraqi Petroleum Sector

Abstract- In the present investigation, titania (TiO₂) nano-thin films were deposited on steel type A106-B, by using the Pulse Laser Deposition (PLD) technique to obtain passive layers of nano-coating. Electrochemical methods (Tafel completion) are used for study corrosion behavior of steel coating. The A106-B specimens were evaluated in 3.5 wt. % NaCl aqueous solution by using polarization technique with pH adjustment to 4.0 in order to determine the corrosion rate. The samples of TiO₂ thin films were characterized by SEM, AFM, XRD, and FTIR. The input parameters were substrate temperature (100, 200 and 300 °C), number of pulse (300, 400 and 500) and fluencies energy (800, 900 and 1000) mJ/cm², have been investigated to detect their impact on corrosion reduction rate using Taguchi methodology orthogonal array and Analysis of Variance (ANOVA). The ANOVA results indicates that number of shoots pulse significantly affecting the corrosion rate in PLD technique, which is highest among the contributions of the other parameters which is (58.03%) about three times of the fluencies energy (19.12%). The results show that the TiO₂ deposition on steels offers an excellent corrosion resistance about 99 times as compared with uncoated steel. The optimum conditions to minimum values corrosion rate are: temperature of 300°C, number of laser pulses at 300, and fluencies energy equal to 1000 mJ/cm². Finally the optimal parameters that was used to predict the conclusions were (98.6) to the response of corrosion rate.

Keywords- Nano-thin film of TiO₂, low carbon steel, PLD, Taguchi design, Corrosion rate.


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