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Testing of Protective Coatings on Automotive Steel, a Correlation Between Salt Spray, Electrochemical Impedance Spectroscopy, and Linear Polarization Resistance Test

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Abstract : Corrosion can cause serious and expensive damage to the automobile components. Various proven techniques for controlling and preventing corrosion depend on the specific material to be protected. Electrochemical Impedance Spectroscopy (EIS) and salt spray tests are commonly used to assess the corrosion degradation mechanism of coatings on metallic surfaces. While, the only test which monitors the corrosion rate in real time is known as Linear Polarisation Resistance (LPR). In this study, electrochemical tests (EIS & LPR) and spray test are reviewed to assess the corrosion resistance and durability of different coatings. The main objective of this study is to correlate the test results obtained using linear polarization resistance (LPR) and Electrochemical Impedance Spectroscopy (EIS) with the results obtained using standard salt spray test. Another objective of this work is to evaluate the performance of various coating systems- CED, Epoxy, Powder coating, Autophoretic, and Zn-trivalent coating for vehicle underbody application. The corrosion resistance coating are assessed. From this study, a promising correlation between different corrosion testing techniques is noted. The most profound observation is that electrochemical tests gives quick estimation of corrosion resistance and can detect the degradation of coatings well before visible signs of damage appear. Furthermore, the corrosion resistances and salt spray life of the coatings investigated were found to be according to the order as follows- CED> powder coating > Autophoretic > epoxy coating > Zn- Trivalent plating.

Keywords : Linear Polarization Resistance (LPR), Electrochemical Impedance Spectroscopy (EIS), salt spray test, sacrificial and barrier coatings
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