

Abstract

In this research, the reliability of two nondestructive corrosion detection methods: Half-Cell Potential (HCP) and Electrical Resistivity (ER), was studied, considering the Weight Loss (WL) as the reference method.

To fulfill the objectives of the research, two types of specimens were fabricated and tested. Plain concrete (PC) cubes of 100 mm side length, tested by the ER method, and reinforced concrete (RC) prisms of 400×100×100 mm in size, were tested by the HCP method, while the rebar was tested by the WL method. The specimens were categorized into three main groups according to the exposure conditions, Reference “R” group where the specimens were exposed to the laboratory conditions, Temperature “T” group where the specimens were subjected to elevated temperature, and Humidity “H” group where the specimens were subjected to humid environments. The severe conditions of high temperature and humidity have been provided through “Al-Nasiriya Power Station”. Each main group consisted of four subgroups defined as the by-weight ratios of salt (NaCl) to cement. The salt was added to the mixing water to accelerate the corrosion process, and the ratios were 0%, 1.5%, 3%, and 4%. For the six months of exposure, the nondestructive tests were weekly performed while the WL test was monthly performed.

The results revealed that the reliability of the HCP technique is questionable and needs further research to detect the corrosion activity precisely. The corrosion evaluated by this method was invalidated by the WL method through a regression analysis relating the NDT with the reference method for all of the severe exposure conditions and chloride contents. Regarding the ER method, the regression analysis unconfirmed the reliability of this method concerning the high temperature severe exposure condition for all of the chloride contents. The high relative humidity, as well, revealed a catastrophic regression analysis relating the ER and the WL methods. Therefore, the reliability of the ER method regarding these two severe exposure conditions still questionable and searchable.

The exposure to high temperatures has slightly increased the corrosion activity of the "T" specimens. While the exposure to high relative humidity has clearly increased the corrosion probability of the "H" specimens, comparing with the "R" specimens

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