

Application of Carbon Nanotubes as Cathodic Corrosion Protection of Steel Reinforcement

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Abstract : Reinforced concrete is one of the most important materials in the construction industry. However, in recent years the durability of concrete structures has been a worrying problem, mainly due to corrosion of reinforcing steel; the consequences of corrosion in all cases lead to shortening of the life of the structure and decrease in quality of service. Since the emergence of this problem, they have implemented different methods or techniques to reduce damage by corrosion of reinforcing steel in concrete structures; as the use of polymeric materials as coatings for the steel rod, spiked inhibitors of concrete during mixing, among others, presenting different limitations in the application of these methods. Because of this, it has been used a method that has proved effective, cathodic protection. That is why due to the properties attributed to carbon nanotubes (CNT), these could act as cathodic corrosion protection. Mounting a three-electrode electrochemical cell, carbon steel as working electrode, saturated calomel electrode (SCE) as the reference electrode, and a graphite rod as a counter electrode to close the system is performed. Samples made were subjected to a cycling process in order to compare the results in the corrosion performance of a coating composed of CNT and the others based on an anticorrosive commercial painting. The samples were tested at room temperature using an electrolyte consisting NaCl and NaOH simulating the typical pH of concrete, ranging from 12.6 to 13.9. Three test samples were made of steel rod, white, with commercial anticorrosive paint and CNT based coating; delimiting the work area to a section of 0.71 cm². Tests cyclic voltammetry and linear voltammetry electrochemical spectroscopy each impedance of the three samples were made with a window of potential vs SCE 0.7 -1.7 a scan rate of 50 mV / s and 100 mV / s. The impedance values were obtained by applying a sine wave of amplitude 50 mV in a frequency range of 100 kHz to 100 MHz. The results obtained in this study show that the CNT based coating applied to the steel rod considerably decreased the corrosion rate compared to the commercial coating of anticorrosive paint, because the E_{corr} was passed increase as the cycling process. The samples tested in all three cases were observed by light microscopy throughout the cycling process and micrographic analysis was performed using scanning electron microscopy (SEM). Results from electrochemical measurements show that the application of the coating containing carbon nanotubes on the surface of the steel rod greatly increases the corrosion resistance, compared to commercial anticorrosive coating.

Keywords : anticorrosive, carbon nanotubes, corrosion, steel

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