



Electrochemical behaviour of high-strength corrugated steel in aerated alkaline mediums

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Summary

In this study, the high-strength corrugated steel wire with a diameter of 7.6 mm was subjected to different aerated alkaline mediums (pH8.2, 12.3 and 13.4) with different concentration of Cl^- . The electrochemical cell was consisted of a working electrode, an auxiliary electrode and a reference electrode, which was the steel wire, the graphite rod and the Ag/AgCl in KCl saturated, respectively. The open circuit potential measurement that lasted for 8 hours and the potentiodynamic polarization measurement from -900 mV to +500 mV were performed on the steel in each different medium and Cl^- concentration. After the measurement, the steel surface was examined under the light microscope to find out the types of corrosions that occurred on the steel. Regardless of the Cl^- concentration, it is found that at the medium of pH8.2 general corrosions are seen on the steel surface, at pH12.3 pitting corrosions, while at pH13.4 no corrosion is observed on the steel.

Keywords: high-strength steel; open circuit potential; potentiodynamic polarization; pitting corrosion.

1. Introduction

High-strength corrugated steel tendon has widely been used as prestressed reinforcement in concrete structure or in open structure such as metal bridge to increase their durability. There is high potential risk that the steel wire undergoes critical localized corrosions that could lead to a catastrophic destruction when the structures are exposed to the aggressive environments. Two main reported aggressive environments are carbonatation [1,2] and the ingress of chloride ion into the concrete [3,4]. Carbonation occurs when CO_2 in the air dissolves into the concrete pore solution and forms a weak carbonic acid in the solution. This reduces the pH of concrete pore solution. Therefore, with the presence of aggressive anions in the concrete pore solution, mainly chloride ion, a passive film that is formed previously on the reinforcement will be attacked by them and thus this leads to the corrosion on the reinforcement. The sources of chloride ions are come mainly from road deicing salts that are sprayed on highways and bridges during the winter or from the sea water to the buildings built alongside the beach.

Lately, the surface texture of high strength steel wire is made corrugated with an intention to give different effects to the pull-out strength of steel in concrete [5, 6]. Somehow, having the corrugated surface, the resistance to the corrosion may be reduced. Paredes et. al [7] reported that the core of corrugated steel has higher resistance to corrosion than the corrugated surface itself. In order to