Crack propagation induced by reinforcing steel corrosion in concrete

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1. Introduction

Cementitous materials have been used for the conditioning of nuclear and non-nuclear hazardous waste materials and for the construction of an engineered barrier in deep geological repositories for radioactive waste. Some disposal facilities for low- and intermediate-level waste (LILW) have been constructed in water-saturated environments. The concrete structure of the disposal facilities is degraded due to reactions with groundwater or sodium salts. Rebar corrosion has been known as one of main causes in concrete degradation.

This paper focused on the experimental examination of rebar corrosion-induced crack formation in concrete.

2. Approach

This study aimed to understand the effect of chloride-induced corrosion on the concrete structure. For this purpose, laboratory-scale experiments were carried out. Firstly, a concrete specimen was cast using ordinary Portland cement (OPC). The mineral composition of the OPC was shown in Table 1. The reinforcing steels were imbedded at the depth of 10 cm in the specimen. Secondly, aggressive environment was applied to the specimen by loading chloride solution of 3.5%. Thirdly, the corrosion of the reinforcing steel was accelerated. This corrosion experiments were conducted for more than one year. The experimental apparatus is shown in Fig. 1.

Finally, the concrete specimen was cut, and the properties of crack were analyzed. The physico-chemical properties of corrosion products were also determined using instrument analysis.

Table Ⅰ: Mineralogical composition of OPC

Mineral	Weight percent (%)
C3S	51.86
C2S	22.29
C3A	9.49
C4AF	8.51
Gypsum	2.03

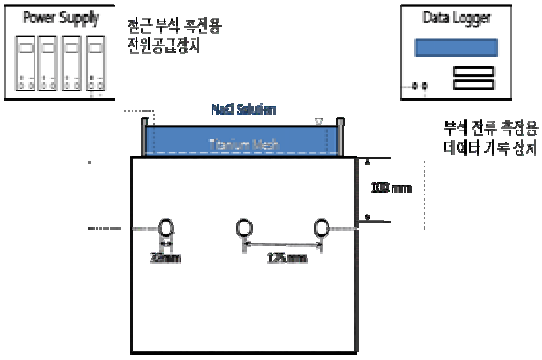

Fig. 1. Experimental set-up

3. Results and Discussion

The aim of this experiment was to measure the crack propagation caused by corrosion of reinforcing steel in concrete. Although the instrumental analysis confirmed that corrosion was taking place, significant crack or expansion in concrete was not observed.. This kind of experimental results were also reported by Smart et al. [1]. The reason for the lack of any detectable crack is probably because the corrosion products were easily compressed.

The experimental results imply that the corrosion of reinforcing steel does not seriously influence the hydraulic conductivity of the concrete.

4. Conclusions

A enhanced corrosion experiment did not detect any significant crack formation in concrete after one year's exposure to artificial aggressive environments.

5. Acknowledgments

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