Durability Study of Reinforced Concrete Subjected to Chloride Attack

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Most nuclear facilities in Korea are located near the seaside. Since concrete wall is primary shielding barrier, durability of concrete is important. For the reinforced concrete structure in marine condition, salt damage is considered as the major factor of concrete corrosion. Chloride induced steel corrosion is one of the major deterioration mechanisms for reinforced concrete structures. And the corrosion of reinforcing bars deteriorates the concrete structures and reduces their service life. Concrete wall temperature of nuclear facility building may be higher than general concrete structure. However, there are few examination examples to make clear the influence of high temperature on corrosion. In this study it is focused that concrete deterioration by chloride attack under high temperature.

Corrosion of reinforcing bars deteriorates the concrete structures and reduces their service life. Chloride ion penetration simulate test has been carried out to obtain the material properties of reinforced concrete at high temperature. Fig. 1 shows the experimental system for corrosion test. It is consist of heater, control box, water tank for NaCl solution and pure water. The concrete samples are made of type I ordinary portland cement(OPC) and the water cement ratio is 55%. Each concrete sample has three bars which has three different cover thickness, 1cm, 2cm and 4cm.

Table 1. Composition of concrete sample (kg)

w/c	55%
Coarse aggregate	11.77
Fine aggregate	8.30
Cement	3.81
Water	2.10

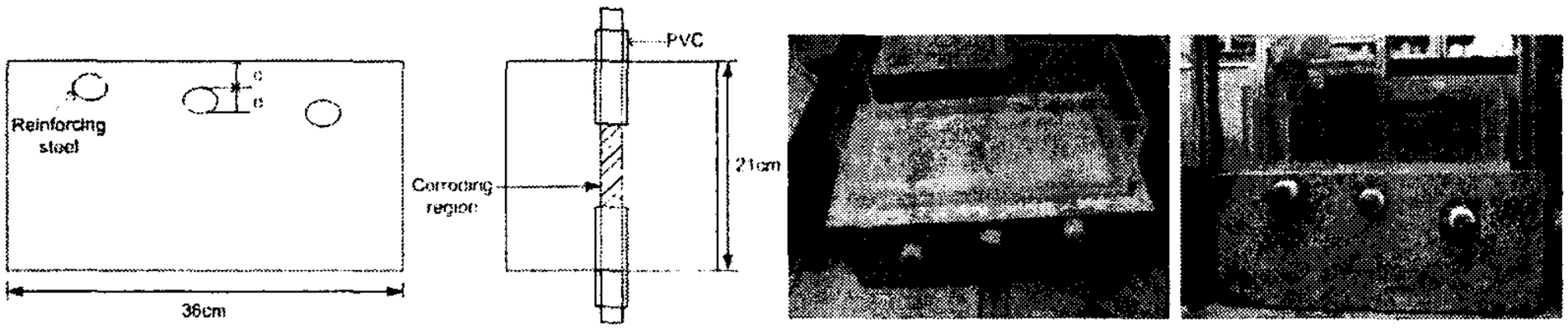

Fig. 1. Concrete sample

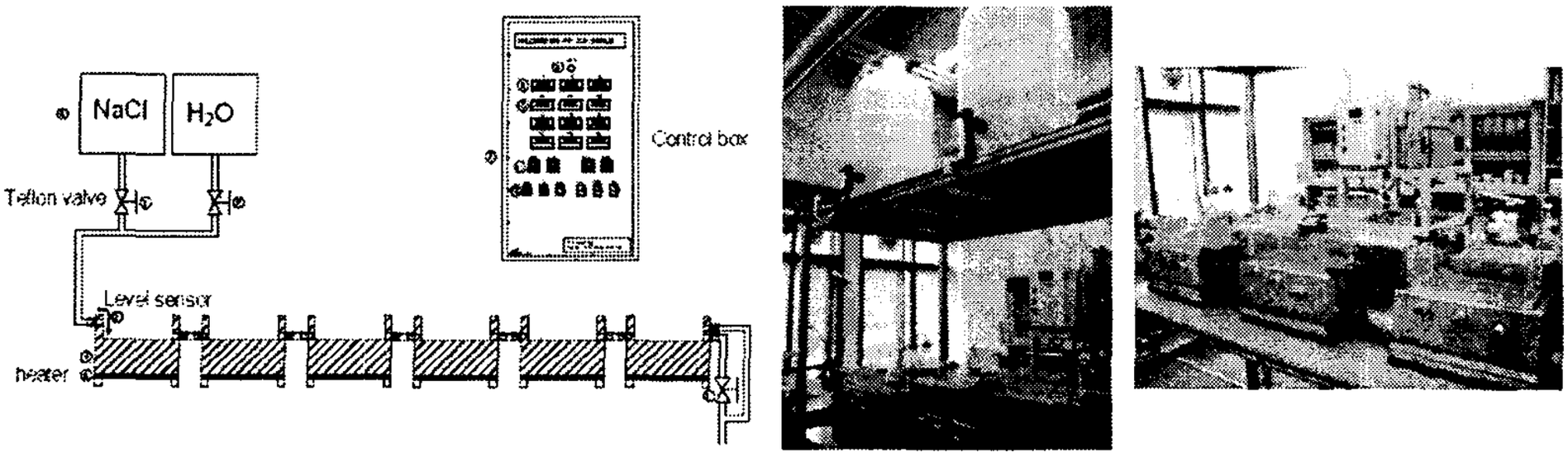

Fig. 2. Experimental system for corrosion test

Six specimen has been used for test, and the temperature of heaters were 30°C, 60°C and 90°C. The surface of concrete specimen was sunk by 3.5% NaCl solution to simulate accelerated chloride penetration. Half-Cell device was used to detect the corrosion of steel bar in concrete samples. The potential difference of steel bar and concrete surface is proportional to corrosion rate.

Table 2. Potential difference (mV)

temp. cover thickness (specimen/heater)	1 cm	2 cm	4 cm
18/30	-155	-66	-37
28/60	-189	-181	-31
30/90	-230	-203	-158

The potential difference as a result of corrosion test is shown in Table 2. It is clear that the cover thickness is in inverse proportion to potential difference. The cover thickness is main shielding protector which inhibit the penetration of harmful factors from the surface to reinforcing bar. It can be noted that the temperature considerably affects degradation of reinforced concrete structure. Corrosion progress tends to be high at high temperature.

Deterioration of concrete in nuclear facilities is very important. The concrete structure for nuclear facility building must withstand the damage due to salt damage under high temperature. This study can be used to the research on deterioration of concrete and estimation of service life.