

## Development of Corrosion Monitoring Method of Reinforced Concrete Due to Salt Agent Splayed for Freezing Prevention

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### Summary

In a cold district, spraying salt agent to the road for prevention of freezing its surface has caused serious corrosion of materials in surrounding area including reinforced steels in concrete structures. Aims of this study is, therefore, development of corrosion monitoring methods of reinforced steels embedded in concrete and corrosion diagnosis system of an entire structure by combining these methods. In this report, three measurement methods are introduced; (i) monitoring of internal atmosphere in concrete, (ii) corrosion monitoring system using multi-electrodes embedded in concrete, and (iii) resistometry with capability of non-uniform corrosion detection. In the subject (i), several sensors including O<sub>2</sub>, CO<sub>2</sub>, temperature, relative humidity and iron foil for corrosion sensing were placed in the sealed the void inside a cement block and the data were recorded. For example, relative humidity increased up to 96% following void sealing using cement due to vaporized water from wet cement. NaCl powder was sprayed on the thin (10 $\mu$ m in thickness) iron foil and corrosion of foil was initiated due to moisture absorption by the salt inside the void after sealing. Corrosion rate of the iron foil was monitored by using a temperature compensated DC resistometry with the accuracy of *ca.* 20nm until breaking off at *ca.* 200 ks after sealing. Oxygen concentration was dropped from initial 16.5% to 14.5% accompanying with corrosion progress of iron foil. CO<sub>2</sub> concentration was also dropped from initial 2,000ppm to 1,000ppm due to absorption by mortar. In the subject (ii), eight iron wires were embedded in the cement block with equal spacing and two of them was sequentially chosen to measure impedance spectra between them with time during water penetration from the one of the surface. Time transition of electric resistance calculated at 1Hz showed clearly the progress of water penetration in depth due to increase in electric conductivity of cement. Time transition of capacitance also showed formation of electric double layer on the iron surface in the swelled cement. Prior to the reaching water to iron wire, slight increase in electric conductivity of cement was observed probably due to moisture absorption. Linear relationship between the electric resistance and distance between the iron wires, electric resistance of cement was estimated depending on water content. In the subject (iii), several techniques were considered using adjacent multiple auxiliary electrodes to enable non-uniform corrosion detection in resistometry. In the experiment 16 auxiliary electrodes were placed close to the Cu foil with partial slit as a resistometry sample to detect AC voltage distribution through the foil. The result showed clear detection of slit but not voltage distribution in the foil, indicating that stronger capacitance coupling was necessary to detect it.