

## Nondestructive Electrochemical Testing Method for Prestressed Concrete Structures

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**Abstract :** Prestressed concrete is used a lot in infrastructures such as roads or bridges. However, poor grout filling and PC steel corrosion are currently major issues of prestressed concrete structures. One of the problems with nondestructive corrosion detection of PC steel is a plastic pipe which covers PC steel. The insulative property of pipe makes a nondestructive diagnosis difficult; therefore a practical technology to detect these defects is necessary for the maintenance of infrastructures. The goal of the research is a development of an electrochemical technique which enables to detect internal defects from the surface of prestressed concrete nondestructively. Ideally, the measurements should be conducted from the surface of structural members to diagnose non-destructively. In the present experiment, a prestressed concrete member is simplified as a layered specimen to simulate a current path between an input and an output electrode on a member surface. The specimens which are layered by mortar and the prestressed concrete constitution materials (steel, polyethylene, stainless steel, or galvanized steel plates) were provided to the alternating current impedance measurement. The magnitude of an applied electric field was 0.01-volt or 1-volt, and the frequency range was from 106 Hz to 10<sup>-2</sup> Hz. The frequency spectrums of impedance, which relate to charge reactions activated by an electric field, were measured to clarify the effects of the material configurations or the properties. In the civil engineering field, the Nyquist diagram is popular to analyze impedance and it is a good way to grasp electric relaxation using a shape of the plot. However, it is slightly not suitable to figure out an influence of a measurement frequency which is reciprocal of reaction time. Hence, Bode diagram is also applied to describe charge reactions in the present paper. From the experiment results, the alternating current impedance method looks to be applicable to the insulative material measurement and eventually prestressed concrete diagnosis. At the same time, the frequency spectrums of impedance show the difference of the material configuration. This is because the charge mobility reflects the variety of substances and also the measuring frequency of the electric field determines migration length of charges which are under the influence of the electric field. However, it could not distinguish the differences of the material thickness and is inferred the difficulties of prestressed concrete diagnosis to identify the amount of an air void or a layer of corrosion product by the technique.

**Keywords :** capacitance, conductance, prestressed concrete, susceptance

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