Linear Polarisation Resistance (LPR) Corrosion Probe for Reinforced Concrete

CLAIMS

1. A linear polarisation Resistance (LPR) corrosion probe comprising two steel bar segments mounted in a molding resin in such way that the exposing length of the steel bar outside the molding resin and the distance between these two steel bar segments are fixed.
2. A corrosion probe as claimed in claim 1, wherein the two steel bar segments are cut from the actual steel bars used for construction and are used as electrodes to reflect the actual corrosion condition in the concrete structure.
3. A corrosion probe as claimed in claim 1, wherein the molding resin is epoxy resin with no electric conductivity and suitable strength and durability in concrete.
4. A corrosion probe as claimed in claim 1, wherein the two electric cables are provided which are electrically connected to the two steel bar segments inside the molding resin.
5. A corrosion probe as claimed in claim 1, wherein the corrosion probe is embedded in the reinforced concrete structure for monitoring of the corrosion rate of steel bars in concrete.
6. A corrosion probe as claimed in claim 1, wherein the corrosion monitoring instruments are connected to the cables to monitor corrosion of the reinforcement in the concrete structure.

DESCRIPTION

TECHNICAL FIELD

The present invention relates to a linear polarisation Resistance (LPR) corrosion probe for use in monitoring the rate of corrosion of steel reinforcement embedded in concrete.

BACKGROUND ART

Concrete, being by far the most widely used produced material on earth, is reinforced with steel to improve its tensile strength for most structural applications. Reinforcing steel tends to be passive in sound, uncontaminated concrete due to high pH (12.5 to 14) of the concrete pore solution. However, it has become increasingly apparent that the steel reinforced concrete infrastructures and structures all over the world are suffering from large-scale degradation , with rebar corrosion as the main deterioration mechanism.

The dominant corrosive agents are chlorides and carbon dioxide, both of which depassivate the rebar surface after migrating into the porous material. The chlorides originate from marine environments or deicing salts, while carbon dioxide comes from the atmosphere. The formation of voluminous corrosion products on the reinforcing steel produces internal stresses in the concrete, which causes cracking and spalling of the concrete. Obviously, such damage leads to further rapid ingress of corrosive species to the reinforcing steel and further rapid attack, eventually leading to significantly reduced load capacity of the reinforced concrete structure.

Corrosion monitoring systems consisting of linear polarization, concrete resistivity and other probes have been installed in new structures to monitor durability and in existing structures to evaluate rehabilitation strategies such as corrosion inhibitor application and patch repairs. Corrosion monitoring, when used in association with “snapshot” surveys can give a more complete picture of the changing condition of a structure in time as well as in the three physical dimensions of the structure.

Polarization resistance is particularly useful as a method to rapidly identify corrosion upsets and initiate remedial action, thereby prolonging plant life and minimizing unscheduled downtime. The technique is utilized to maximum effect, when installed as a continuous monitoring system. However, commercially available probes or sensors used for corrosion monitoring in concrete structures are different from the actual rebars used on the construction sites. The surface condition, the heat and the fabrication of rebars affect the rate of reaction (the corrosion rate).

It is the object of the present invention to use rebars taken from the construction site for making LPR probes to minimize this effect.

SUMMARY OF THE INVENTION

The present invention provides a linear polarisation Resistance (LPR) corrosion probe comprising two steel bar segments mounted in a molding resin in such way that the exposing length of the steel bar outside the molding resin and the distance between these two steel bar segments are fixed. Two steel bar segments cut from the actual steel bars used for construction are used as electrodes to reflect the actual corrosion condition in the concrete structure. Two electric cables are provided which are electrically connected to the two steel bar segments inside the molding resin. The probe is embedded in the reinforced concrete structure. Corrosion monitoring instruments are connected to the cables to monitor corrosion of the reinforcement in the concrete structure.

By using the LPR corrosion probe of the present invention, the corrosion rate of steel bars in concrete structure can be monitored accurately, economically and easily.

The invention also provides a LPR corrosion probe with simple production, long lasting and easy application.

DISCLOSURE OF THE INVENTION

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings.

The illustrated probe comprises two electrodes 1 of normal steel bar segments taken from construction site. The electrodes 1 are mounted in the molding resin 2 of rigid non-conductive materials such as epoxy resin. The electrodes 1 are connected to the electric wires 3 by soldering or mechanical joining such as self-tapping fasteners 4. The another ends of the electric wires then can be connected to the corrosion monitoring instrument.

The procedure of making the probe in present invention can be as follows:

a) The rebar taken from construction site is cut into appropriate segments suitable for intended site installation as LPR probes.

b) The sharp/rough edges due to cutting are grinded.

c) The section to be embedded into the molding compound is cleaned from rust/dirt while the section to be exposed as sensing elements is not be treated.

d) Electrical cable is fixed to the rebar through soldering or mechanical joining such as self-tapping fasteners.

e) The electrical connection is verified using a multi-meter.

f) Molding compound is properly mixed according to the instruction of the supplier.

g) The rebars are fixed in the mould through ring stand/clamps or other supporting facilities.

h) Casting the molding compound in the mould.

i) After the molding compound has cured, the electrical connection of the LPR probe is verified.

The LPR probe made from the above procedures can only be interfaced with commercially available datalogger after calibration. The state-of-the-art potentiostat, Solartron 1287 Electrochemical Interface can be used for the purpose of calibration.