



Each year, the direct cost of steel corrosion to the U.S. economy is \$276 billion, or 3.1% of its gross domestic product. That's according to a study by Houston-based NACE International–The Corrosion Society titled “Corrosion Costs and Preventive Strategies in the United States.” With so much potential to help mitigate these costs, it's expected that inventors are searching for the latest breakthrough in the science of rebar-corrosion protection.

“Cathodic Protection of Steel in Reinforced Concrete with Electro-osmotic Treatment,” which was invented by Efim Lyublinski of Mayfield, Ohio, and which received U.S. Patent No. 6,419,816 on July 16, 2002 and was assigned to Cor/Sci LLC in Cleveland, is the latest development. Typically, the designs of reinforced steel structures such as bridges, marine structures such as docks, and roadways are cathodically protected using an impressed current. But older reinforced or prestressed concrete structures cannot be protected adequately without first counteracting or eliminating the corrosion source. So the problem of protecting aged reinforced concrete structures is markedly different from cathodically protecting newly embedded rebar and prestressing strand in a concrete structure.

The new invention addresses an existing corrosive environment using the electro-osmotic removal of corrosive anions from within aged and contaminated concrete. No one has ever considered the effect of first using an electro-osmotic current to deplete corrosive ions in concrete and then protecting the reinforcing members in the anion-depleted concrete with an impressed cathodic current. Nor has

# Corrosion Inhibition

▶ Invention disrupts a harmful environment using an electrical current.

anyone considered first using an electro-osmotic current to deplete the corrosive ions, then—without shutting off the electro-osmotic current—concurrently providing an impressed cathodic current to protect the reinforcing members.

The system uses electro-osmotic current to indicate the depletion of harmful anions. Then, within 6 months, the contractor applies an impressed cathodic current at a comparably low voltage. A decrease in the current density required for cathodic protection, coupled with low installation and operational costs of the system, improves the efficiency of a conventional cathodic protection system and better protects the structure. Although the electro-osmotic treatment may use the reinforcing members in the concrete as a cathode, it is better to use a cathode located outside of the concrete structure.

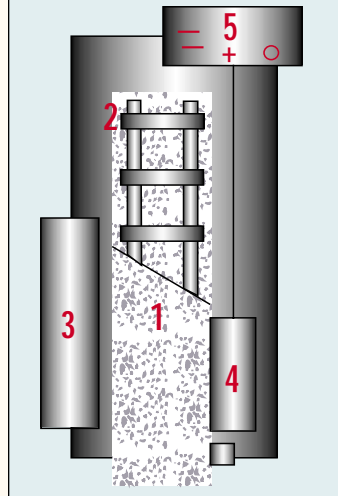
The invention offers the contractor some flexibility. The equipment necessary to use these methods can be incorporated into the structure during construction or retrofitted to existing structures. So corroded elements can be repaired while in service and protected for the rest of their service lives.

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To receive a copy of the NACE International–The Corrosion Society report titled “Corrosion Costs and Preventive Strategies in the United States,” e-mail Raymond L. Poltorak at the trade group: [ray.poltorak@mail.nace.org](mailto:ray.poltorak@mail.nace.org).

## A New Method of Cathodic Protection

A new patent protects a concrete element (1) from corrosion of rebar (2). An electro-osmotic current causes cations to migrate to a cathode (3) and draws anions to an anode (4) with the help of a power supply (5).



Efim Lyublinski's "Cathodic Protection of Steel in Reinforced Concrete with Electro-osmotic Treatment."