

Development of an Electro-Plasma Process for Cleaning and Coating Steel

Starting date: 1/01/00
Duration: 18 months
Completion date: 06/30/01
Funding: FHWA
Principal Investigator:
Dr. E.I. Meletis
Louisiana State University

LTRC Contacts:

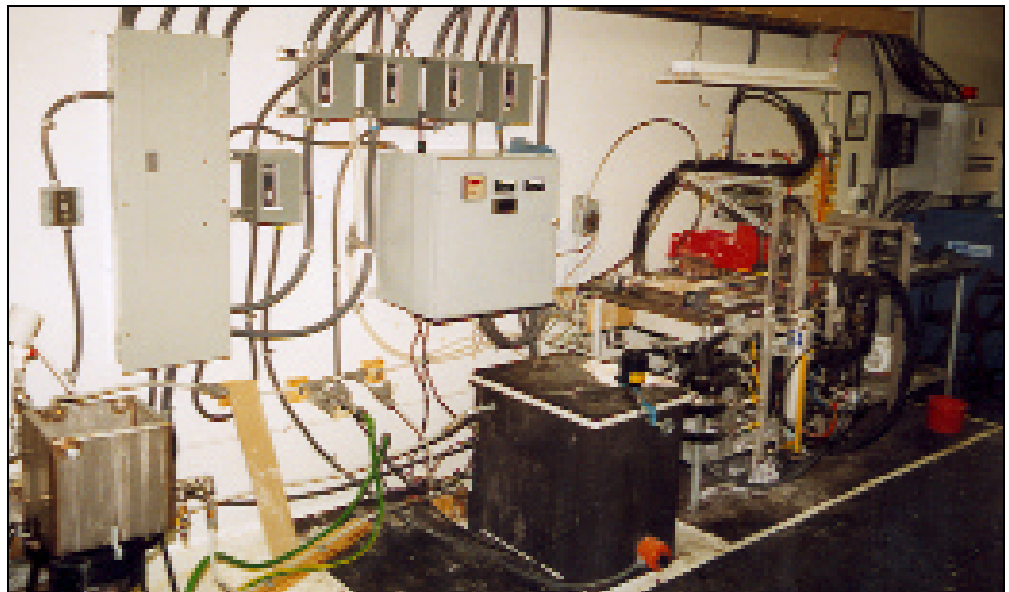
Administrative:
Harold "Skip" Paul
Assoc. Director, Research
(225)767-9102

Technical:
Art Rogers, P.E.
Research Manager
(225)767-9166

Problem

Huge amounts of steel are used in the highway system, making corrosion resistance, longevity, and maintenance of steel structures of utmost importance in preserving and advancing the infrastructure. In order to prolong the life of steel structures, application of protective coatings is required to prevent corrosion. Adhesion of the coating is of utmost importance and is directly related to the cleanliness of the surface and the ability to develop an "anchor" surface profile (surface

with micro-roughness). Steel must first be cleaned to remove the film or layer of mill-scale and contaminants of oil and grease. Current practices of cleaning steel have major disadvantages (high-energy cost, unfriendly with the environment, disposal problems, unfavorable surface profile, etc.). Electrolytic cleaning methods are known, but have not been successfully commercialized. Likewise, current metal coating methods have several limitations. Electro-plasma cleaning and deposition (EPCAD) is a patented, environmentally-friendly technology that has the potential to



Electro-plasma cleaning and deposition (EPCAD) is a patented, environmentally friendly technology that has the potential to overcome many limitations and drawbacks of conventional methods for cleaning and metal-coating steel.



LTRC



Louisiana Transportation
Research Center

Sponsored jointly by the
Louisiana Department of
Transportation and Development
and
Louisiana State University

4101 Gourrier Avenue
Baton Rouge, LA 70808-4443

overcome many of the limitations and drawbacks of conventional methods for cleaning and metal-coating steel. Cleaning and coating can be carried out simultaneously and economically, offering significant advantages over existing technologies. These capabilities have been demonstrated in the laboratory but the process needs further development.

Objectives

The objective of the research is the development of a new cleaning and coating technology that can produce significant improvements in longevity of steel structures and reinforcements.

The specific objectives of the proposed work are as follows:

- (a) To study the effect of critical processing parameters on surface cleaning and surface micro-roughness.
- (b) To establish optimum conditions for achieving quality coatings and control coating thickness. Coating systems to be investigated include Zn, Al, and Zn-Al alloys.
- (c) To establish process variables for achieving and coating treatments in a single step.

Description

The substrate material used for this study will be low carbon steel. It will be studied in two forms, as flat plate (~200 mm wide and 3.2 mm thick) and bar (12 mm - 25 mm diameter). The initial condition of the steel will vary and will include the presence of mill scale and rust or general soil. The present scope of work will be composed of the following tasks.

Task 1: Determine the effect of processing parameters on uniformity and quality of cleaning and surface roughness (smooth and rough).

Task 2: Characterize and evaluate cleaned surfaces.

Task 3: Characterize and analyze electrolyte composition parameters as a function of usage (area treated) and establish steady-state operation requirements.

Task 4: Concentrate on coating processes.

Task 5: Characterization of coating quality and properties.

Task 6: Based on the results of the previous tasks, this task will search for sets of process parameters that can achieve simultaneous cleaning and coating.

Implementation Potential

The results and developed technology have applications in steel structures in bridges and elevated highways as well as in steel rebar reinforcements of bridge decks. All federal and state transportation departments could potentially benefit from the results of this project.