2017 Award Nomination

Title of Innovation:
Soluble Salt Profiler

Nominee(s)
Michael Sellars, Managing Director
John Maguire, R & D Director
Paul Stansfield, Product Development Manager
Mike Shanahan, Electronic Technology Lead
Dan Frydman, Electronics Engineer
Anthony Marshall, Embedded Software Engineer
Graham Hopper, Senior Mechanical Engineer

Category:
Instrumentation

Dates of Innovation Development:
May 2013 (Elcometer 130 redesign) to November 2015

Web site:

Summary Description:
The Elcometer 130 Soluble Salt Profiler (SSP) provides fast and accurate measurement of the level and density of soluble salts on steel surfaces. Over 4 times faster than other Bresle equivalent methods, the SSP allows a Bresle equivalent test to be completed in just over two minutes.
The multi-point conductivity sensors enable the Elcometer 130 SSP to accurately display salt concentration, showing exactly where the contamination lies and generating full colour salt density maps in 2D or 3D.

In addition to soluble salt levels (cleanliness) or conductivity, the SSP carries out a detailed analysis of the test area - providing an accurate salt density profile map, pinpointing areas of high contamination outside user defined limits.

This new, easy to use, Elcometer 130 SSP has automatic temperature compensation ensuring accuracy in all climatic conditions. Impure water can be offset for accurate and repeatable readings.

The SSP wirelessly transmits readings, statistics and batches via Bluetooth® or via a USB cable directly to an inspection application or into ElcoMaster®, Elcometer’s Mobile App, for instant report generation at a desk or, using a mobile device, in the field.

A Calibration Verification Tile is available for verifying the accuracy of the gauge in the field. The verification date is recorded for use in reports.

Key features of the Soluble Salt Profiler include:

• Range of measurement modes: displays readings in µg/cm², ppm, µS/cm, mS/cm, % salinity or mg/m²

• Cleanliness: two measurement options are available when measuring soluble salts – Bresle Method Equivalency or Elcometer 130 Equivalency mode

• Conductivity: ideal for measuring ionic contaminants, sometimes referred to as total dissolved solids (TDS), within a solution

• Multi-point conductivity sensor allows the trend in conductivity to be displayed as a density map

• Automatic temperature compensation

• Stores up to 3,500 sets of readings in 1,000 alpha numeric batches

• Non-oxidising gold plated contacts ensure lifetime performance
Full Description:
(Please provide complete answers to the questions below. Graphs, charts, and photos can be inserted to support the answers.)

1. What is the innovation?
The Elcometer 130 Surface Salt Profiler allows the concentration of soluble salts to be determined and mapped over the area of the saturated filter paper used to extract the sample from the surface.

2. How does the innovation work?
The Elcometer 130 Surface Salt Profiler uses the saturated filter method to extract the soluble salts from a steel surface either after abrasive blast cleaning or, if required, before the surface is cleaned. The conductivity is then determined using a novel matrix of contacts so that the concentration profile of the soluble salts can be determined from point to point over the area of the paper. These individual salt concentrations can then be mapped to show the trends and high spots over the area of measurement.

3. Describe the corrosion problem or technological gap that sparked the development of the innovation? How does the innovation improve upon existing methods/technologies to address this corrosion problem or provide a new solution to bridge the technology gap?
Contamination of blast cleaned steel surfaces by soluble salts, in particular chlorides, sulphates and nitrates, prior to application of protective coatings leads to premature coating failure resulting from corrosion. It has become common practice to include a salt contamination test prior to the application of the first coat to ensure the required cleanliness. There are several methods that can be used and these methods are described in SSPC Guide 15.

However, it is well known that salt does not crystallise evenly over a surface when soluble salt solutions contaminate a steel surface in marine, urban or rural environments. Preferential crystallisation occurs causing high spots in the distribution of the salts, which in turn lead to spots of corrosion causing a protective coating to fail. It is therefore necessary to take account of the area being tested to avoid these high spots being overlooked in the averaging process of the test method.

It had been thought that using distilled water to extract the salts from the surface into solution would produce a reliable value for test solutions measured using a conductivity meter. Testing using the traditional methods, including the saturated filter paper method, has demonstrated that the salts are not distributed evenly and the saturated filter paper method for extracting the soluble salt test solution replicated the high and low spots over the area of the paper.

In practice, it is not possible to test significant areas of a blasted surface using any of the methods described in SSPC Guide 15 and only relatively small areas can be sampled, particularly using the Bresle Patch method. The saturated filter paper covers an area of 78.55 cm², whereas the standard Bresle Patch has a test area of 12.5 cm². The area of the filter paper is approximately equivalent to four Bresle Patches arranged in a square.
The Elcometer 130 Soluble Salt Profiler allows the area of the filter paper to be mapped using the multi-point conductivity sensors arranged in a matrix so that individual data points can be collected and analyzed.

4. Has the innovation been tested in the laboratory or in the field? If so, please describe any tests or field demonstrations and the results that support the capability and feasibility of the innovation.

under laboratory conditions in accordance with ISO 8502-9, the Elcometer 130 SSP provides equivalent measurements to the Bresle Patch.

For a copy of the full report and analysis please [click here](#).

**METHOD.**

To show equivalency of measurement between the Bresle Method Tested and the Elcometer 130 SSP it is essential that all parameters are identical except the gauges under test.

For equivalency to be established, both gauges should read a similar value, taking into account the accuracy and resolution of each test.

**TEST METHOD.**

Working with the School of Materials at the University of Manchester (UK) an automated, repeatable and reproducible doping method was developed to apply a known salt concentration uniformly over a large panel.

Over 200 individual tests were undertaken across a range of concentrations and blast profiles.

**Nominal steel grit blast profiles**

- Smooth <25µm (1.0mils)
- 25 to 50µm (1.0 to 2.0mils)
- 50 to 75µm (2.0 to 3.0mils)
- 75 to 150µm (3.0 to 6.0mils)

**Surface salt concentration levels**

- 15mg/m2 to 25mg/m2
- 25mg/m2 to 35mg/m2
35mg/m² to 45mg/m²
• 45mg/m² to 55mg/m²
• >55 mg/m²

Testing was undertaken under strict laboratory conditions, with each method tested in accordance with the manufacturer’s instructions.

RESULTS

“The Elcometer 130 SSP measurement equivalency is less than 0.46µg/cm² across all concentrations on smooth and blasted substrates, almost half the background contamination of a Bresle Patch.”

The Elcometer 130 SSP has undergone extensive side by side comparison testing against the Bresle Test Patch Method.

Background (inherent) contamination within the Bresle Test Patch has shown that the Bresle Test Patch has a background contamination range of 0.88µg/cm² (8.8mg/m²).

The variation in readings between the Elcometer 130 SSP and the Bresle Test method are significantly within the background contamination range of the Bresle Patches (0.88µg/cm²); being less than 0.41µg/cm² for concentrations below 8.0µg/cm², and less than 0.46µg/cm² across concentrations below 16.5µg/cm².
5. How can the innovation be incorporated into existing corrosion prevention and control activities and how does it benefit the industry/industries it serves (i.e., does it provide a cost and/or time savings; improve an inspection, testing, or data collection process; help to extend the service life of assets or corrosion-control systems, etc.)?

The Elcometer 130 SSP can be used as a Bresle Equivalent test for surface contamination after blasting and the method is over four times quicker than the Bresle Patch method as it is described in ISO 8502-6.

6. Is the innovation commercially available? If yes, how long has it been utilized? If not, what is the next step in making the innovation commercially available? What are the challenges, if any, that may affect further development or use of this innovation and how could they be overcome?

The Elcometer 130 SSP is commercially available and was launched to our distribution network in November 2015 and made commercially available in January of 2016.

7. Are there any patents related to this work? If yes, please provide the patent title, number, and inventor.

Title: Contamination Meter

Pending Patent Number GB2527766

Inventor: Michael John Maguire, John Joseph Shanahan