



# **DISRUPTIVE TECHNOLOGY IN THE ELECTRIC POWER MARKET**

**PIONEER TECHNOLOGY SOLUTIONS, INC**

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**PIONEER**  
TECHNOLOGY SOLUTIONS



## Introduction

As the world's population continues to grow at an exponential rate, the demand for electric power has increased significantly, forcing electric power producers and distributors to improve the efficiency and performance of transmission lines and associated components. The efficiency and performance of the electric power grid depends on its ability to deliver power without a break in continuity, thus avoiding power outages which cause economic losses and impact the lives of millions of people worldwide.

### **What is NANOTECHNOLOGY?** **Hydrophobic Nano Coatings**

The electric power industry has been researching alternative solutions to the insulator contamination problem since 2010. One of the recent areas of research has focused on the field of 'Nanotechnology'.

Nanotechnology is science conducted at the nanoscale, which is 1 to 100 nanometers. One nanometer is a billionth of a meter. Essentially, nanotechnology relies on controlling and manipulating individual atoms and molecules. Key advantages to working at the nanoscale level include higher strength, lighter weight, increased control of the light spectrum, and greater chemical reactivity than working on a larger scale.

Hydrophobic nanocoatings are currently available in the marketplace and are used to protect silica surfaces such as glass, porcelain or granite from water stains and other contamination by making the surface highly hydrophobic. Current industries include aerospace, automotive, architectural glass, residential glass (used for shower doors to prevent hard water stains from forming on the surface). When applied to a silica-based substrate, our nanocoating forms a covalent bond. In a covalent bond, the coating shares the electrons within the surface itself, thus becoming a part of it. This points to the fact that the adherence factor in our nanocoating is higher than regular coatings.



## WHAT IS THE PROBLEM?

Keeping the power grid functioning at optimal levels includes limiting or mitigating performance issues associated with contamination of insulators caused by environmental pollution. When pollutants that accumulate on the surface of the insulator are combined with fog, dew or high humidity factors, a conducting layer is formed on the insulator as a result of reduction in surface resistance. This causes increased leakage which results in the formation of dry bands, which in turn cause arcing and ultimately lead to flashovers.

Porcelain and glass insulators become contaminated and the solutions for addressing the problem are ineffective.

Common contaminants are:

- ☐ Salt from the ocean
- ☐ Urban dust
- ☐ Minerals from cooling towers
- ☐ Pollution from factories or mining activity
- ☐ Road salt
- ☐ Chemicals used in agricultural activities such as fertilizers



## **FIELD TEST SITES**

### **New York Contamination and Icing Insulator Site**

#### Description of Test Site

A substation has experienced flashovers due to the amount of road salt used on a local highway as well as marine contaminants from a brackish river. Pioneer coated 3 cable terminations. The remaining 3 cable terminations were left uncoated to serve as control samples. The cable terminations are monitored using leakage current sensors together with a weather station (temperature, humidity, precipitation).

This test was commissioned November 16<sup>th</sup>, 2015 and is currently still in progress. See below for pictures of installation.

Some key takeaways from applying the coatings were to thoroughly clean the porcelain cable terminations prior to applying the coating. This is the most important step of the coating process. Proper cleaning of the surface will ensure the best performance of coating. All cleaning and application of the coating was performed by hand.



**Personnel cleaning and applying coating to bushings–November 16<sup>th</sup>, 2015**





**Coated bushing with leakage current sensor installed**







**August 22, 2018 - 32 months in service**





**August 22, 2018 - 32 months in service – closeup**







## **Georgia Contamination Insulator Site**

### **Description of Test Site**

The substation has been experiencing a number of outages due to contamination problems. The sources of the contamination are the local cooling towers which are located where the prevailing winds carry the steam discharge across the substation causing self-contamination.

**Contaminated insulator replaced with a 'new' one on April 28<sup>th</sup> 2016.**





138kV porcelain post insulators were used as the test samples. Pioneer coated 2 insulators. The coated insulators are new units that were installed after applying the coatings. The remaining 2 insulators were left uncoated to serve as control samples and have been in service for 6 months. The insulators are being monitored with leakage current sensors. This test was commissioned **April 28th, 2016** and is currently still in progress. See below for pictures of installation.





24 months after installation, the coated insulators that were installed have shown little contamination build up.

**Picture taken May 2<sup>nd</sup> 2018**





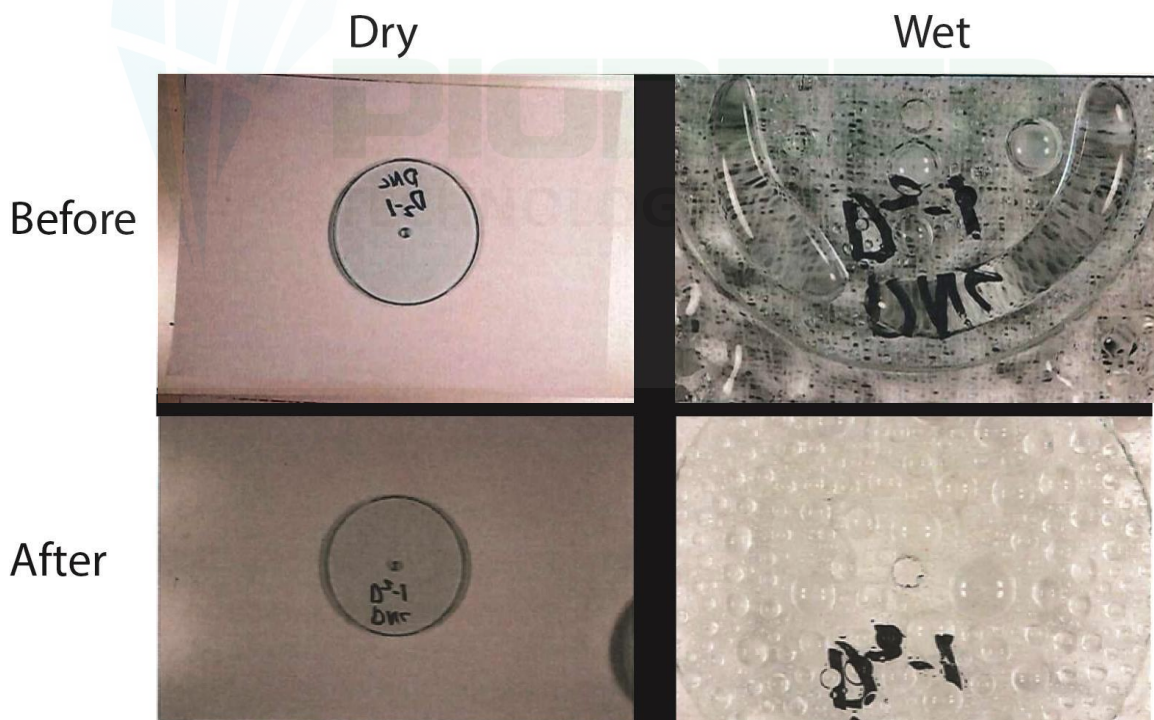


## VERIFIED RESULTS!

We've run our coating through 3rd party independent laboratory testing of nano hydrophobic coatings (results for your review upon request) and we are confident we have the product that will allow your systems to run at peak efficiency and keeping the potential of contamination at bay.

### Recovery:

This picture captures the results of the 'Thermal' test ANSI C29.11 (mod.). It was performed on glass that had been used for a Taber® Abrasion test and as a result some of the substrate was removed. As you can see the 'Hydrophobicity' recovered after the Thermal test!





## **WHY THIS IS THE SOLUTION YOU NEED.**

The disruptive nanotechnology within our hydrophobic coating improves the performance of insulators, with a focus on durability, longevity, effectiveness, expense, and ease of application. When applied to glass and ceramic insulators, hydrophobic nanocoatings reduce the adherence of water, salt, dirt and other contaminants to the surface of insulator. Unlike existing coating methods, which are expensive, time - consuming and temporary, our nanocoatings are optically clear as they are only up to 100 nanometers thick. The covalent bond (which won't peel, chip, or crack) is meant to create higher adherence, which would indicate the coating would last longer.

The end results will please all involved!

Reduction/elimination of contamination takes away the buildup that could lead to flashovers and system outages. Having a low maintenance coating from Pioneer Technology Solutions leads to less on-site repairs and downtimes for cleaning. The more efficient, full running system, leads to happier stakeholders at every step in the process!





## COATING OPTIONS

### Factory

We have a machine that can **efficiently coat the insulators in a factory setting** and be ready for shipping within an hour.



### On-Site

You can treat the insulators on-site in the field using our 'Hand Applied' product. It is easy to apply and dry's in less than a minute.



## THANK YOU.

FOR MORE INFORMATION CONTACT: STUART HELGASON  
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