

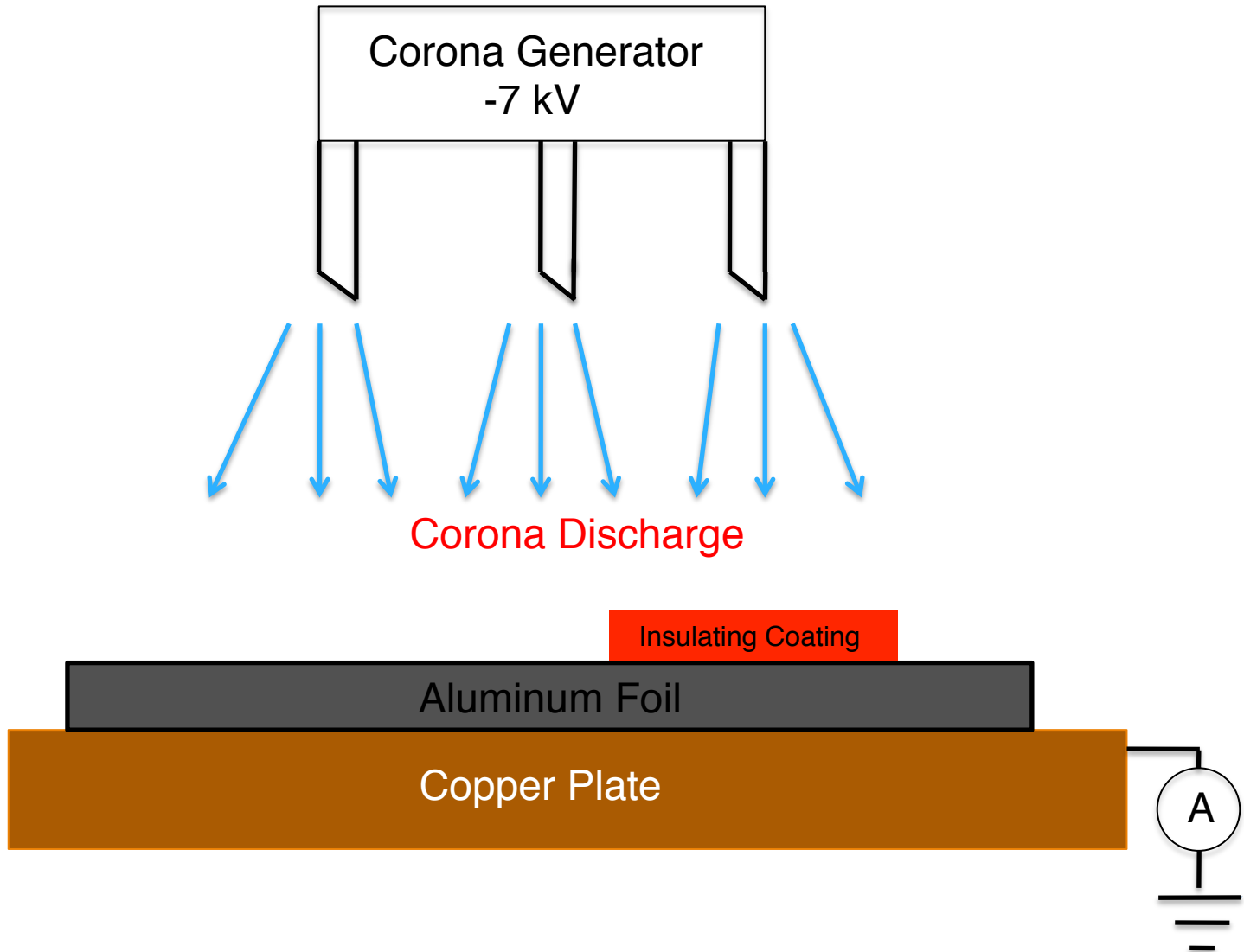
Decoration of Defects in Protective Coatings of Metals

Ben Kelsner

Motivations

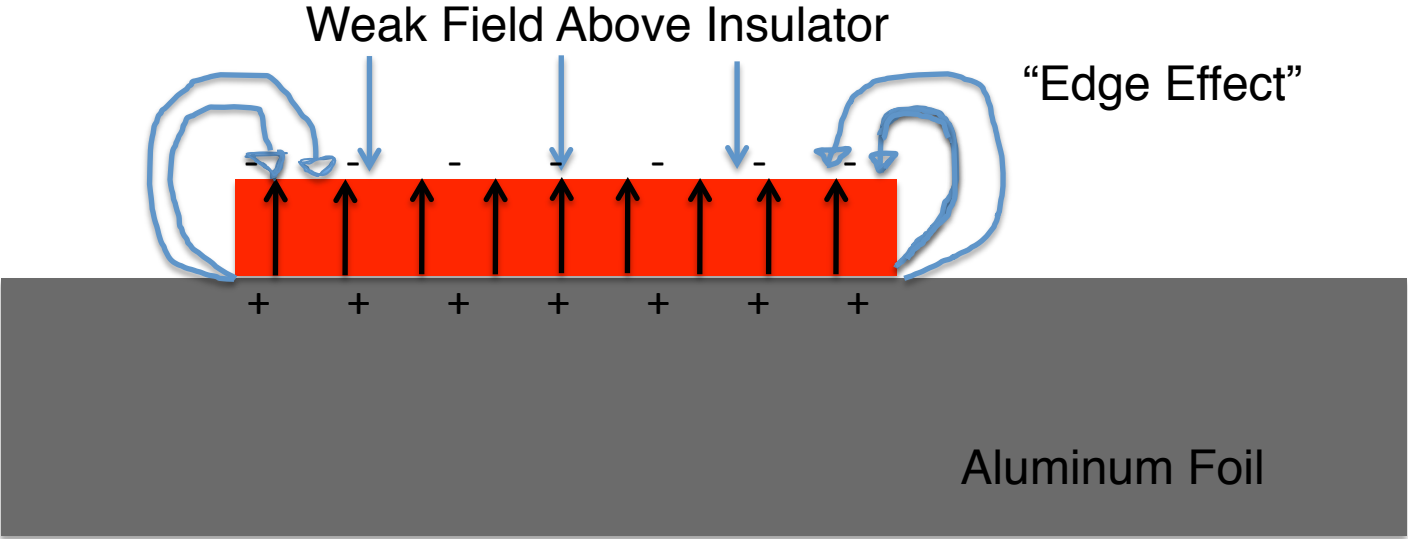
- I wanted to see if defects in protective coatings of metals could be visualized by a technique involving static charging and subsequent decoration.
- This technique would work if the coatings were electrically insulating.
- I wanted to characterize the range of defect sizes which could be detected using this technique.

Experimental Setup

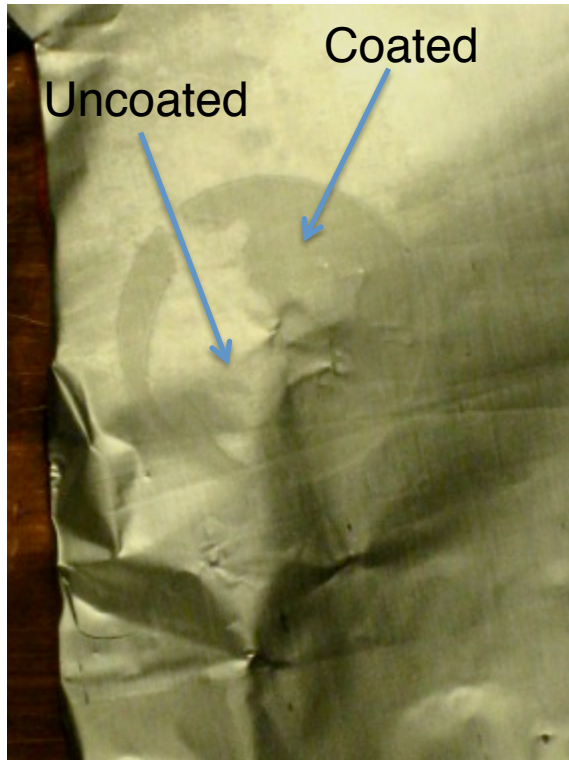


Negative corona ions were showered from the generator onto the partially coated aluminum foil. The sample sat on a grounded copper plate. The corona current (ca. 1 μA) was monitored with an ammeter.

Electric Field



Pooh and Piglet Shadow Mask



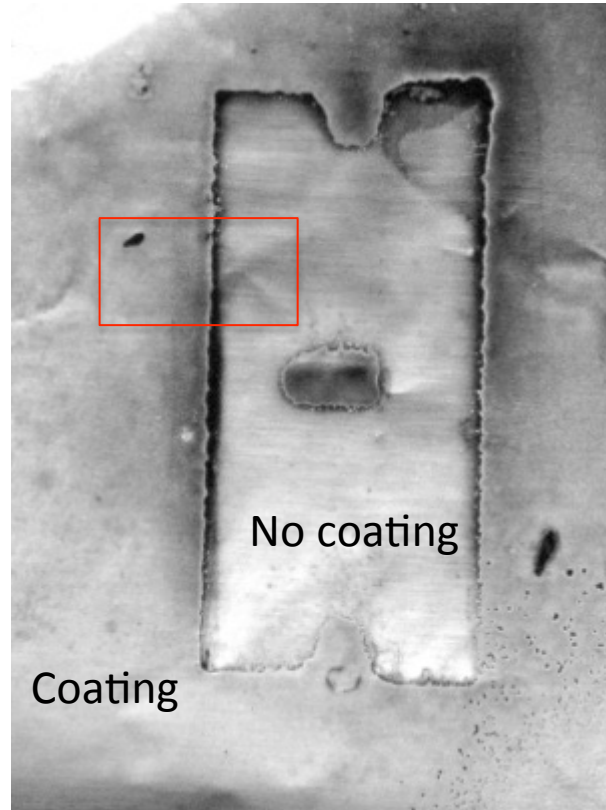
Krylon-sprayed sample before decoration.



Sample after decoration.

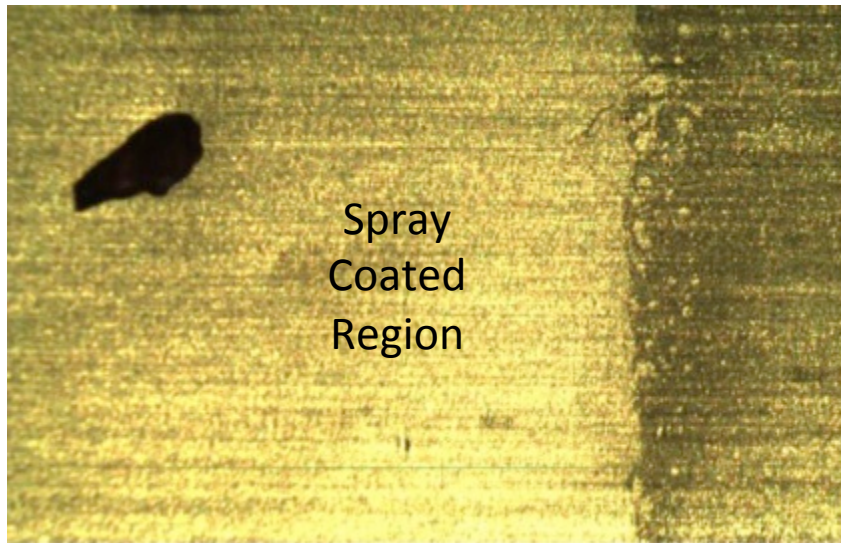
- The negative corona ions established an electric field in the insulating coating. Only a small electric field existed above the insulator. However, there was a strong fringing field around the edges of the coating. This results in the well-known Xerographic “edge effect”.
- The charged sample was subsequently dusted by positively charged toner particles obtained from a commercial copy machine. The carbon black particles were directed according to the electric field lines.

Krylon Sprayed Razor Blade Shadow

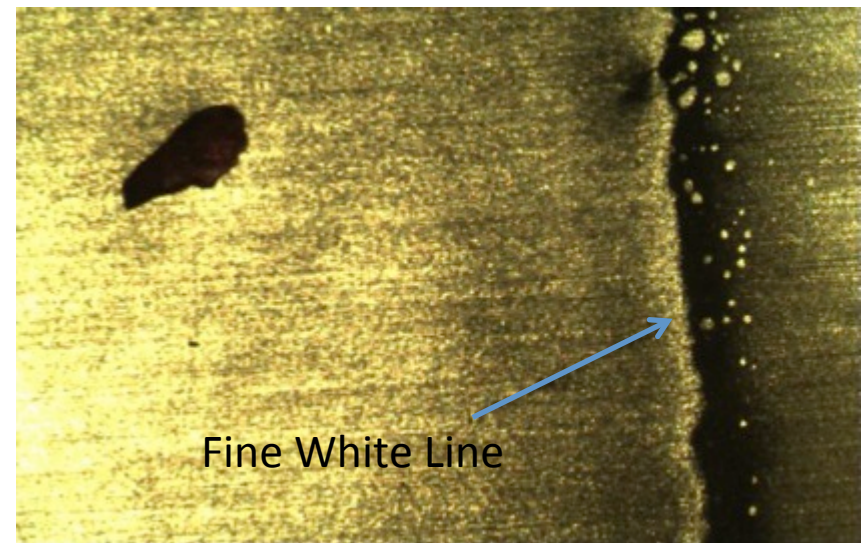


The decorations revealed fine details at the coating boundaries.

Razor Blade Close-ups

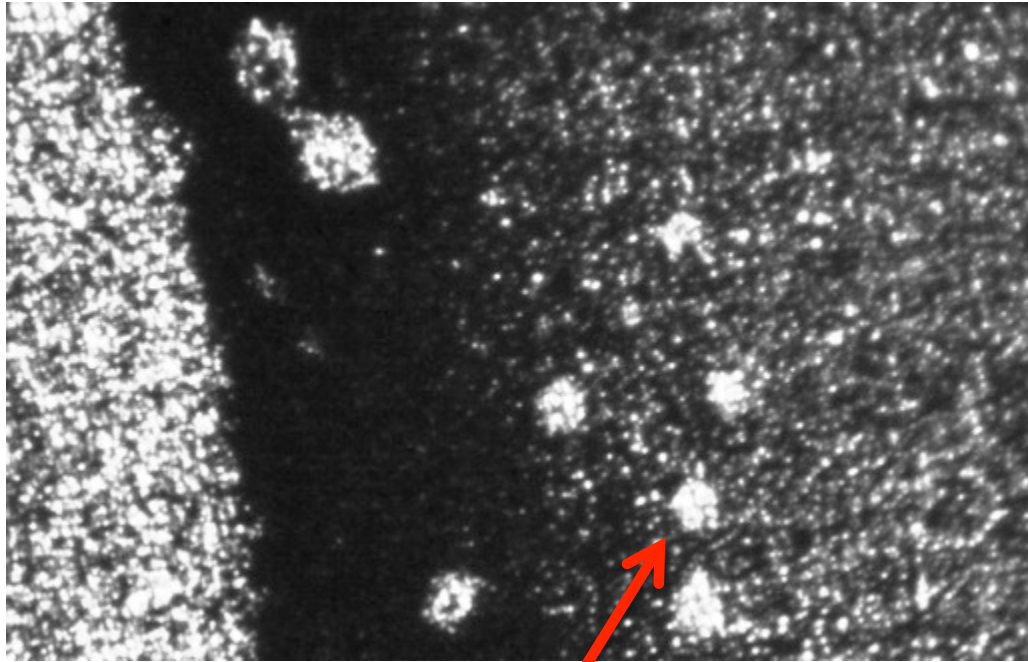


Coated metal before decoration and charging.



After charging and subsequent decoration with toner particles. The white line is an artifact of the Krylon spray buildup at the barrier edge.

Scale of Sample Images

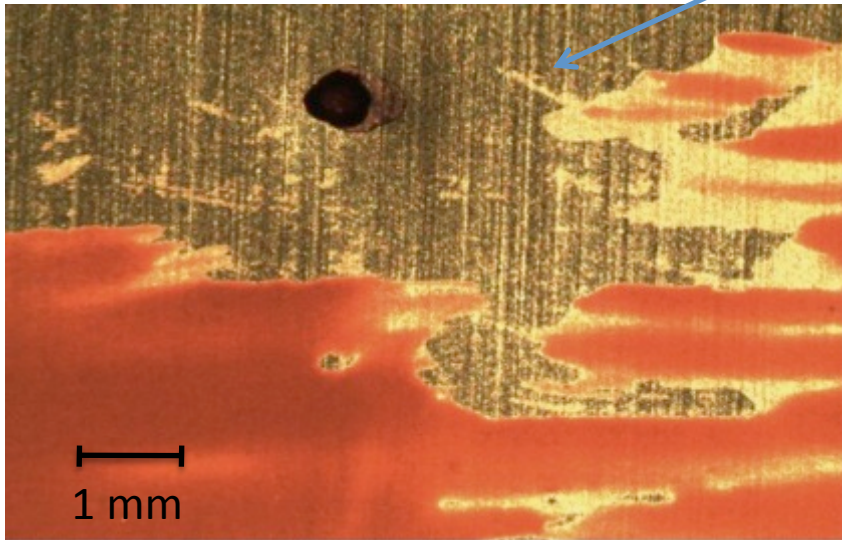


50 μm Diameter Coating Defects

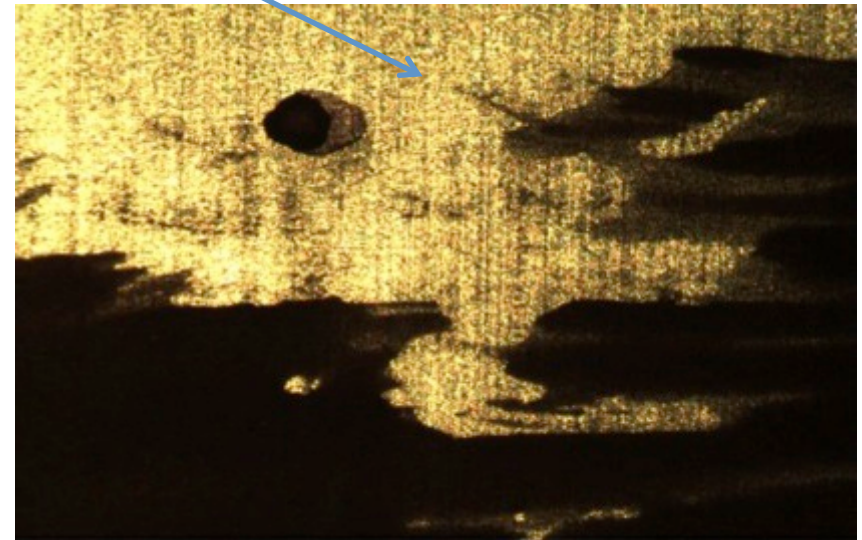
These are islands of coatings which leaked under the edge and remained after the removal of the razor blade. Some spray migration under the blade edge seems to have occurred.

“Corona Dope” Samples

Even smallest of coated regions get decorated.



Sample before charging.



Sample after charging and subsequent decoration.

Applications

- This technique can be used to visualize small area defects in insulating coatings for purposes of quality control.
- In addition to the electrical equipment field, this technique could be used to test for defects of all products with insulating or protective coatings. e.g. lacquered musical instruments

Conclusion/Future Directions

- Negative static charging followed by decoration with positive particles successfully enhanced coating visibility.
- The minimum defect feature able to be visualized was approximately 50 μm .
- In the future I will try direct decoration by charging with a positive corona. The uncoated regions should be revealed.