Atmospheric Plasma Coating Removal: The Future Without Spent Abrasive

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Summary

- Plasma – What is it?
  - What is atmospheric plasma?
  - How is it used to remove coatings?
  - Atmospheric Plasma Coating Removal (APCR)

- Testing Overview
  - Manual and Automated Coating Removal
  - Steel thickness and Heat Effects
  - Effects of APCR on profile
  - Adhesion Test Results

- Real World Applications
  - Successful Uses
  - Where the Technology is Headed
Plasma: 4\textsuperscript{th} State of Matter
How APCR Works

APCR converts organic components of most paints, sealants and protective coatings into carbon dioxide and water vapor.
## Features and Benefits of APCR Technology

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
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<tr>
<td>No Media Required</td>
<td>Cost - Reduced procurement, storage, and disposal costs</td>
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<td></td>
<td>Safety - Reduced exposure to hazardous materials</td>
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<td>Environmental – Reduced environmental impact</td>
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<td>Atmospheric Pressure Operation</td>
<td>Non-damaging removal, preserves surface profile</td>
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<td></td>
<td>Selective layer-by-layer removal</td>
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<td></td>
<td>Simple technology requires compressed air and electricity</td>
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<tr>
<td></td>
<td>Safety – No special safety equipment or procedures</td>
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<td></td>
<td>Cost – Eliminates need for “hot work” zones, faster maintenance cycle</td>
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<td>Compact size, low weight</td>
<td>Controlled manually or by robotics</td>
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<td>Reaches areas that are inaccessible to other technologies</td>
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Testing Overview

Scope
To investigate the effect of APCR on the adhesion strength of an polyamide epoxy coating system applied to DH36 steel.

Purpose of Study
To show that APCR could be effectively used to remove coatings from steel substrates and leave a surface that is ready for recoating and provide similar adhesion to that of a grit blasted surface.

Testing Method
- Polyamide epoxy was applied to grit-blasted DH36 steel.
- Three panel thicknesses were used: 1/8in, 1/4in, and 3/8in.
- APCR was used to remove the epoxy coating on a section of each panel.
- Epoxy coating was re-applied to APCR treated sections.
- Adhesion testing was conducted on both APCR-treated and grit-blasted sections and results compared.
APCR System: Manual and Automated

Handheld plasma pen

Automated APCR system

APCR power supply and cable assembly
Handheld APCR Treatment

Samples treated with Handheld APCR
Handheld APCR Treatment

Samples treated with Handheld APCR – Back Side
Handheld APCR Treatment

Photograph of surface before painting and plasma treatment.

Photograph of the same surface after painting and APCR. Many of the same features can be seen in both images.
Automated APCR Treatment

Samples treated with Automated APCR
Automated APCR Treatment

The top row shows the backs of the samples before receiving any treatment. The bottom row shows the same samples after grit blasting and automated APCR. No temperature damage is observed.
Average Coating Adhesion after Manual APCR vs. Untreated

Graph of results of dolly pull tests, with results of samples of the same type averaged. The error bars show the range of data for each column.
Graph of results of dolly pull tests, with results of samples of the same type averaged. The error bars show the range of data for each column.
### Coatings
- Silicone Alkyd Coatings
- Polysiloxane Coatings and Sealants
- Anti-Fouling Coating Systems
- Epoxy-Polyamide Primer
- Fluoropolyurethane Aviation Coating
- Polysulfide Sealants
- Epoxy Nonskid Coating
- Polyurea Sealants

### Substrates
- AH/DH-36 Steel
- Low Alloy High-Strength Steel
- 6061, 2024, 7075 Aluminum
- Ti 6Al-4V Titanium
- AZ61 Magnesium
- Carbon Fiber
- GRP / Fiberglass
- Nomex/Kevlar Composites
- Concrete, Brick, Masonry
Where APCR Technology Is Headed

- Field-Deployable
  - Solid-state plasma power supply and single beam plasma pen
  - HEPA vacuum and filtration system for dust recovery
  - Dry compressed air source (< 3 CFM @90 psi)
  - 208-240 V, single-phase AC power
- Multi-Beam Array for Large Area Removal
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Conclusions

• The Atmospheric Plasma Coating Removal (APCR) process presents an effective way to remove coatings from virtually any substrate material.

• APCR is:
  • Substantially More Cost Effective
  • Environmentally Friendly
  • Efficient
  • Performed Using No Abrasive

• Efficacy of the APCR technology has been demonstrated for both commercial and defense applications.

• Technology shows excellent promise for cost effective field coating removal projects and enhanced coating removal and substrate preparation production rates.
Thank you

Any Questions?