

# CTIO Non-Chrome Project Update

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Sustainable Development

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# Briefing Overview



- **Super Primer**
- **Mg Rich Primer**
- **Electroactive Polymer Pretreat**



# Super Primer



- **SERDP Project**
  - **University of Cincinnati**
- **SBIR**
- **Did not perform as hoped**
- **CTIO to conduct further testing**



# Mg Rich Primer



- **Primer being produced by Seashell Technologies**
- **North Dakota State University (NDSU) formulation**
- **CTIO to conduct coatings system testing**
  - **Test plan finished**



# Electroactive Polymers (EAP) Background



- Electroactive polymer (a poly(phenylene vinylene)) as pretreatment to replace hexavalent chrome on aluminum alloys.
- The Office of Naval Research (ONR) funded initial synthesis and corrosion testing efforts using BAM-PPV using NAVAIR China Lake developed EAP
- Strategic Environmental Research and Development Program (SERDP) funded scale-up, accelerated weathering tests, and mechanism studies from FY00-FY04



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# Electroactive Polymers (EAP) Background



- Navy holds the patent
- Spectra Group Ltd. intends on obtaining a license agreement to produce the polymer
- ESTCP Project
  - Army (ARL)
  - Wright Patterson Air Force Base (WPAFB) (CTIO)
  - NAVAIR facilities (China Lake, Patuxet River, NADEP).





# Electroactive Polymers (EAP) Substrates



## Aluminum:

- **AA2024-T3  
Bare 0.032"**
- **AA2024-O  
Bare 0.020"**
- **AA7075-T6  
Bare 0.032"**
- **AA5083-H116  
0.125"**
- **AA6061-T6  
0.032"**

## Steel:

- **4130 Normalized –  
Grit-Blasted  
0.050"**
- **4130 Normalized –  
Solvent-cleaned  
0.050"**



# Electroactive Polymers (EAP) Pretreatments



- **Alodine 1200S**  
**(MIL-DTL-81706)**
- **BAM-PPV**
  - **poly(bis-(dialkylamino)phenylene vinylene)**
- **MEH-PPV**
- **PreKote**



# Electroactive Polymers (EAP) Primers & Topcoats



## Primers:

- **Deft 02-Y-40A**  
**(MIL-PRF-23377, C)**
- **Deft 02-GN-083**  
**(non-chromated)**
- **Deft 02-GN-084**  
**(non-chromated)**
- **Hentzen**  
**16708TEP/16709CEH**  
**(MIL-PRF-23377, N)**

## Topcoats:

- **Deft 03-GY-321**  
**(MIL-PRF-85285)**
- **Deft 99-GY-001**  
**(MIL-PRF-85285**  
**APC)**



# Electroactive Polymers (EAP) Tests



- **ASTM B 117 Salt Spray**
- **ASTM D 3359 Crosshatch Adhesion**
- **Wet-tape Adhesion**
- **ASTM D 4541 PATTI Adhesion**
- **MIL-L-23699 Lubricating Oil Fluid Resistance**
- **MIL-PRF-83282 Hydraulic Fluid Resistance**
- **MIL-DTL-5624 JP-5 Fuel Resistance**
- **Accelerated Weathering (Xenon Arc)**
- **Xenon Arc + Corrosion Resistance**
- **Xenon Arc + Crosshatch Adhesion**
- **Outdoor Exposure**
- **GE Impact**
- **GM9540P**



# MEH-PPV Adhesion Results

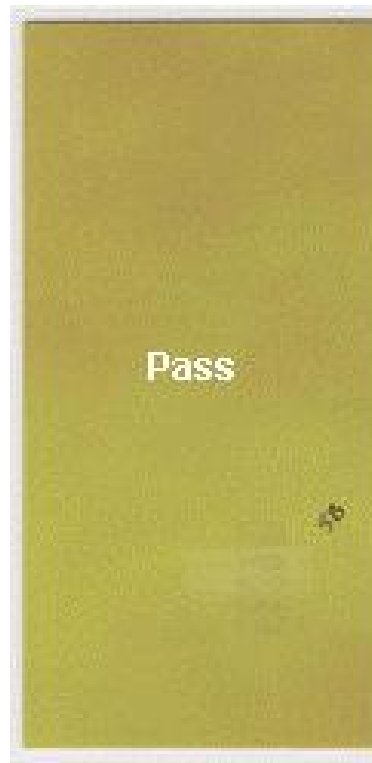


MEH-PPV adhesion is poor alone, but acceptable with standard system

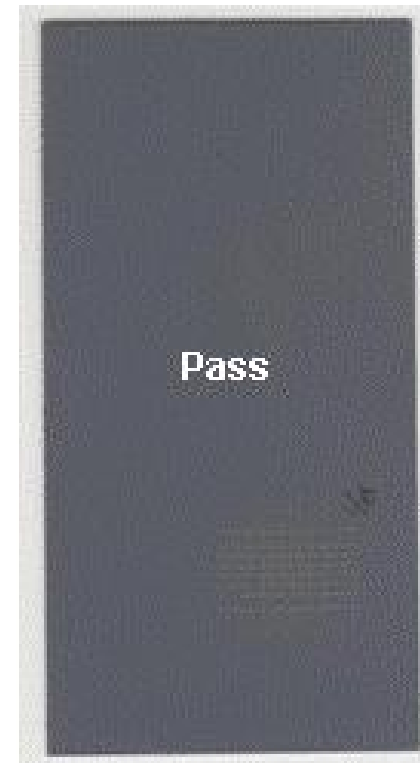
## MEH-PPV Adhesion



**MEH-PPV in Oxsol-100**



**MEH-PPV in Oxsol-100  
+ MIL-PRF-23377**



**MEH-PPV in Oxsol-100  
+ MIL-PRF-23377  
+ MIL-PRF-85285 APC**



# MEH-PPV Salt Spray



Results are comparable to Alodine 1200S with the standard system

## MEH-PPV Salt Spray



**MEH-PPV in Oxsol-100**



**MEH-PPV in Oxsol-100  
+ MIL-PRF-23377**



**MEH-PPV in Oxsol-100  
+ MIL-PRF-23377  
+ MIL-PRF-85285 APC**



# MEH-PPV Results



- **MEH-PPV was tested with either Oxsol-100 or p-Xylene**
- **Results were comparable between the two solvents**
  - **only Oxsol-100 data**
- **Adhesion for MEH-PPV alone is poor**
  - **Adhesion for MEH-PPV coated with MIL-PRF-23377 is acceptable**
  - **Adhesion for MEH-PPV coated with MIL-PRF-23377 & MIL-PRF-85285 APC is acceptable**
- **Salt Spray for MEH-PPV alone for 168 hours is comparable to Alodine 1200S**
- **Salt Spray for MEH-PPV coated with MIL-PRF-23377 alone & MIL-PRF-85285 APC exposed for 2000 hours comparable to Alodine 1200S coated with these materials.**



# BAM-PPV Salt Spray 336 hrs



## BAM-PPV Salt Spray – 336 hours







# BAM-PPV Salt Spray 1000 hrs MIL-PRF-23377 Primer



## BAM-PPV Salt Spray – 1000 hours

753-A28-002



**BAM-PPV in Oxsol-100  
MIL-PRF-23377 Chromated**

753-A29-002



**BAM-PPV in Oxsol-100  
MIL-PRF-23377 Chromated  
MIL-PRF-85285**

753-A30-002



**BAM-PPV in Oxsol-100  
MIL-PRF-23377 Chromated  
MIL-PRF-85285 APC**



# BAM-PPV Salt Spray 1000 hrs

## Deft 02-GN-83 NC Primer



### BAM-PPV Salt Spray – 1000 hours



**BAM-PPV in Oxsel-100**  
Non-Chromated  
Deft 02-GN-083



**BAM-PPV in Oxsel-100**  
Non-Chromated  
Deft 02-GN-083  
MIL-PRF-85285



**BAM-PPV in Oxsel-100**  
Non-Chromated  
Deft 02-GN-083  
MIL-PRF-85285 APC



# BAM-PPV Salt Spray 1000 hrs

## Deft 02-GN-84 NC Primer



### BAM-PPV Salt Spray – 1000 hours



753-A34-002

**BAM-PPV in Oxsol-100  
Non-Chromated  
Deft 02-GN-84**



753-A35-002

**BAM-PPV in Oxsol-100  
Non-Chromated  
Deft 02-GN-84  
MIL-PRF-85285**



753-A36-003

**BAM-PPV in Oxsol-100  
Non-Chromated  
Deft 02-GN-84  
MIL-PRF-85285 APC**



# BAM-PPV Salt Spray 1000 hrs Hentzen NC Primer



## BAM-PPV Salt Spray – 1000 hours



**BAM-PPV in Oxsol-100  
Non-Chromated  
Hentzen**



**BAM-PPV in Oxsol-100  
Non-Chromated  
Hentzen  
MIL-PRF-85285**



**BAM-PPV in Oxsol-100  
Non-Chromated  
Hentzen  
MIL-PRF-85285 APC**



# BAM-PPV Testing



- **Data summary for BAM-PPV testing provides data on completed testing on AA2024-T3 substrate only and does not address the ongoing tests (i.e., PATTI, Xenon Arc Exposure, Salt Spray Exposure, Outdoor Weathering Exposure, GM9540P)**
- **Additionally, BAM-PPV data on steel and other aluminum substrates is not presented and is ongoing.**
- **Current images from samples at last salt spray exposure check are included for update purposes only, but no specific rating can be as pass/fail until completion of the test.**



# Questions?



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