Use of Electrospark Deposition for Repair of Navy Components

March 2005 HCAT Meeting
Greensboro, NC

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Report Documentation Page

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Targeted Applications

- Steering & Diving Control Rods
- Hull Valve Stems
- Alloy 625 Seawater Components

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Control Rods and Seawater Hull Valve Stems

- ***ISSUE***

  Unacceptable corrosion/wear of Alloy K500 control rods and valve stems

- ***SOLUTION***

  Electrospark deposition of Alloy 400 to re-establish original dimensions

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Hull Valve Stem

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Steering and Diving Control Rod

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Steering and Diving Control Rod

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ESD Repair Status
Control Rods and Valve Stems

- Optimized ESD Parameters
  - Metallographic Assessment of Coating Quality
  - Microhardness Measurements
  - Bend Testing

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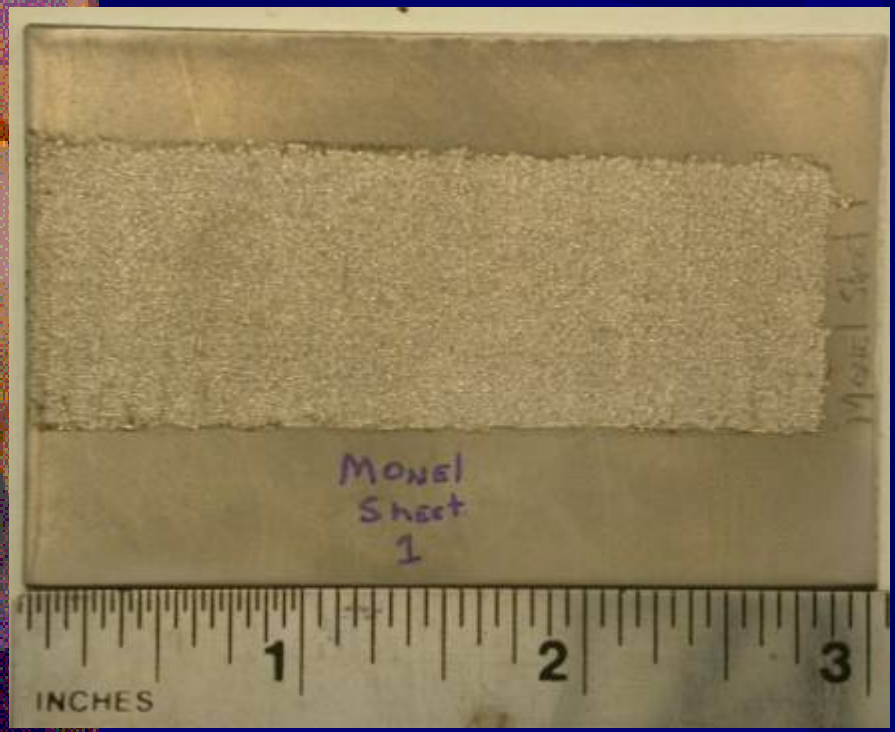
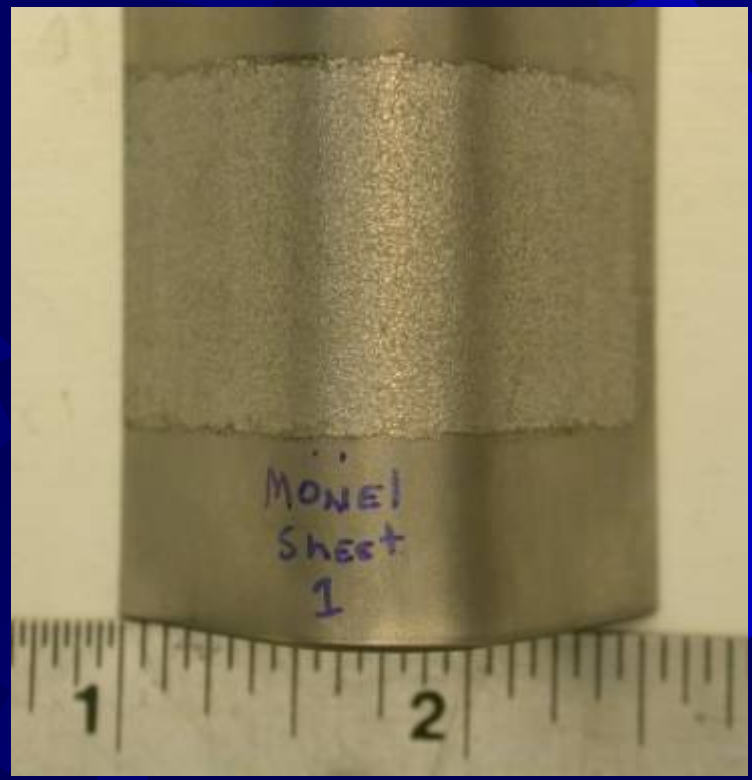
ESD Repair Status - Bend Testing



Before Bend Test

After Bend Test



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ESD Repair Status
Control Rods and Valve Stems

- Completed Corrosion Evaluation
  - Potentiodynamic Polarization
  - Seawater Immersion
  - GM9540P Accelerated Corrosion Testing
- Developed Draft Process Instruction for Control Rod Repair

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ESD Control Rod Repair

Before Repair

Defect Measured
0.016” to 0.021” in Depth

After Repair

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ESD Control Rod Repair

Before Repair

Defect Measured
0.012” to 0.017” in Depth

After Repair

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ESD Control Rod Repair

Defect Measured
0.006” Maximum Depth

Before Repair

After Repair

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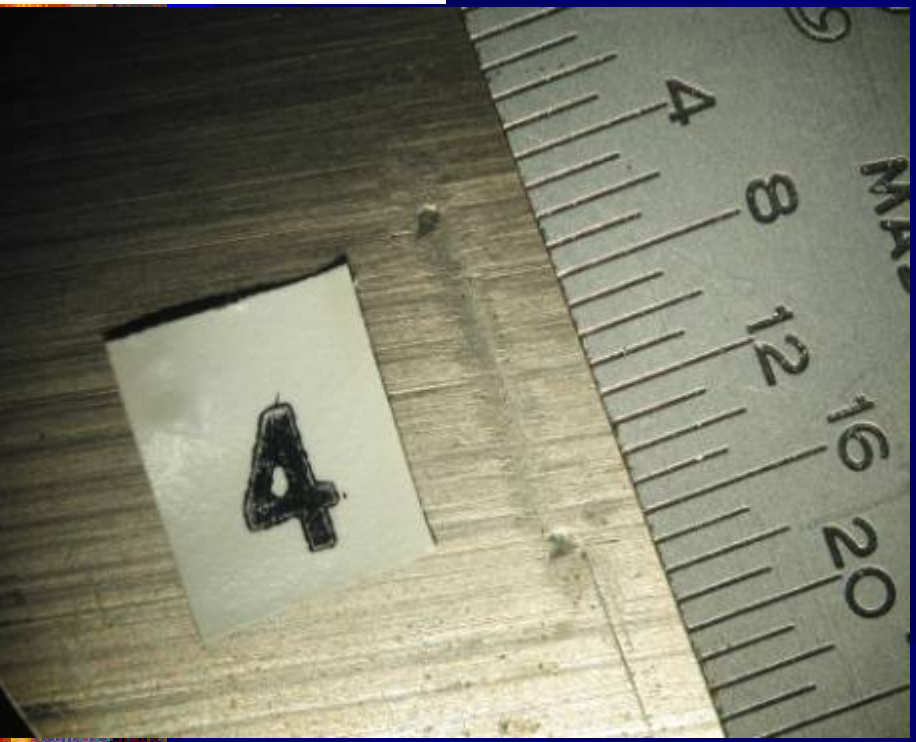
ESD Control Rod Repair

Before Repair



Defect Measured
0.003” to 0.013” in Depth

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After Repair

ESD Control Rod Repair

Future Work

- Metallographic Evaluation
- Seawater Corrosion Testing
- Sliding Wear Testing
- NDE Methods for Evaluating Repair Quality

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Crevice Corrosion Repair of Alloy 625 Components

- Develop NSWCCD Capability to Deposit Crevice Corrosion Resistant Ni-Cr-Mo Alloys on 625 Substrates
  - Alloy C276
  - Alloy 59
  - Alloy 686

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ESD of Ni-Cr-Mo Alloys on Alloy 625

Crevice Corrosion Testing

- ESD Coatings of Alloy 686, C276, and 59 Applied on Alloy 625 Panels
- Control Specimens Include Uncoated Alloy 686, C276, 59, and 625
- Triplicate Specimens Exposed per Condition for 180 and 365 Days in Filtered, Natural Seawater Immersion

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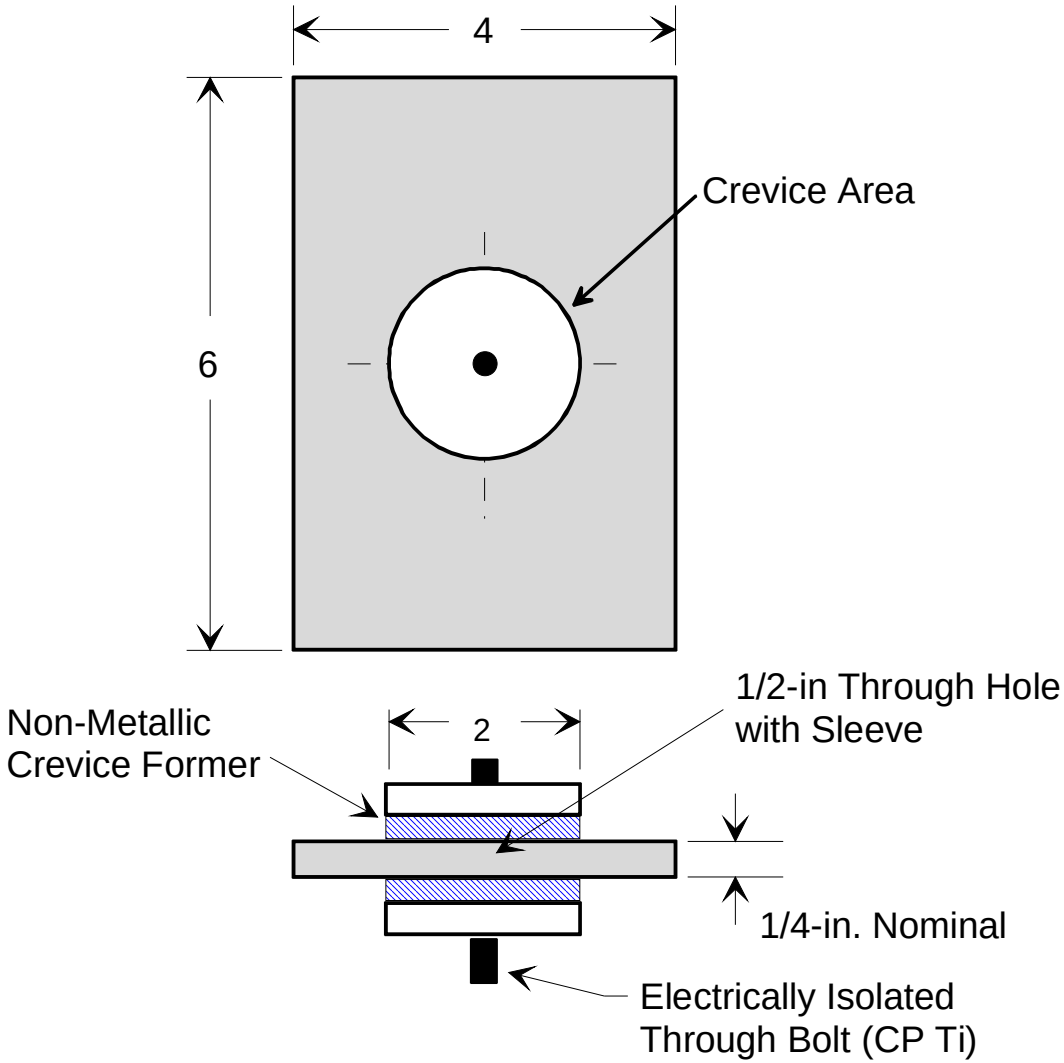
ESD of Ni-Cr-Mo Alloys on Alloy 625

Crevice Corrosion Testing in Natural Seawater



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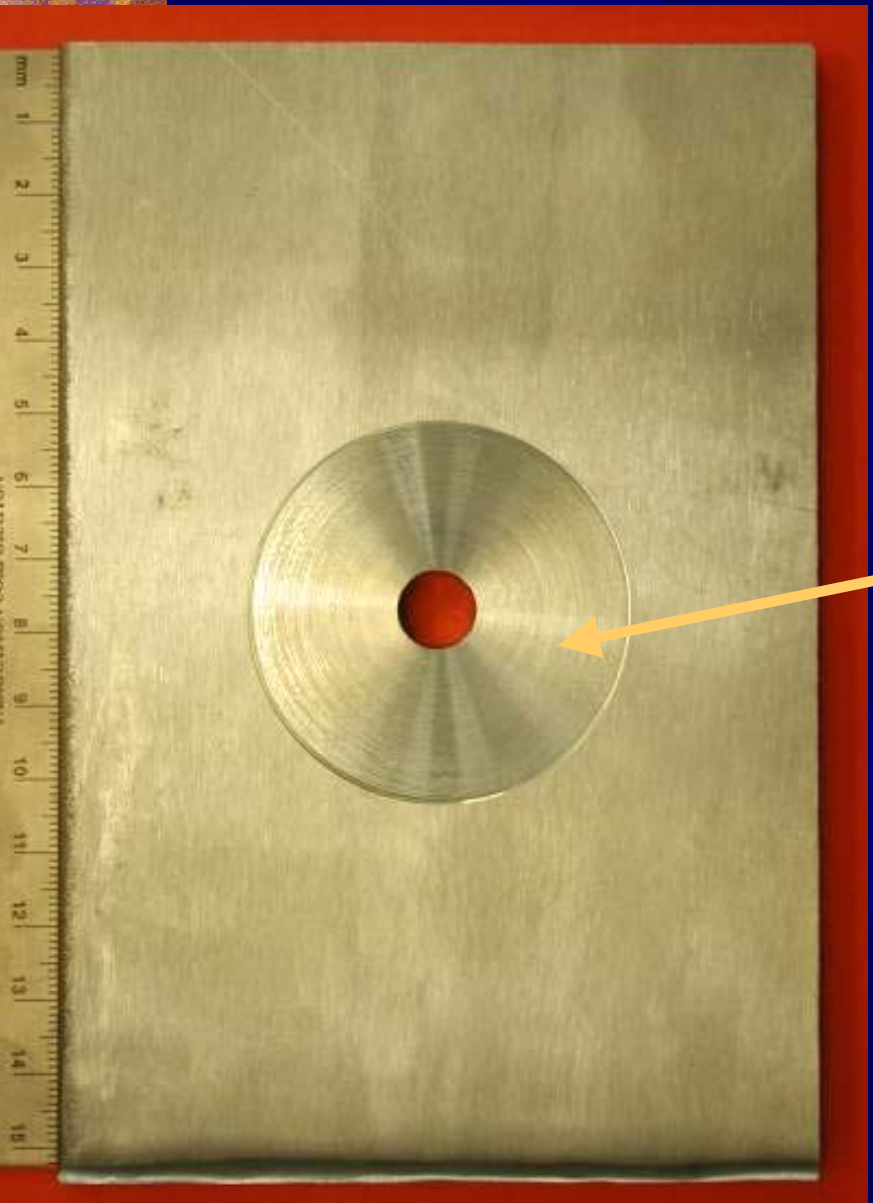
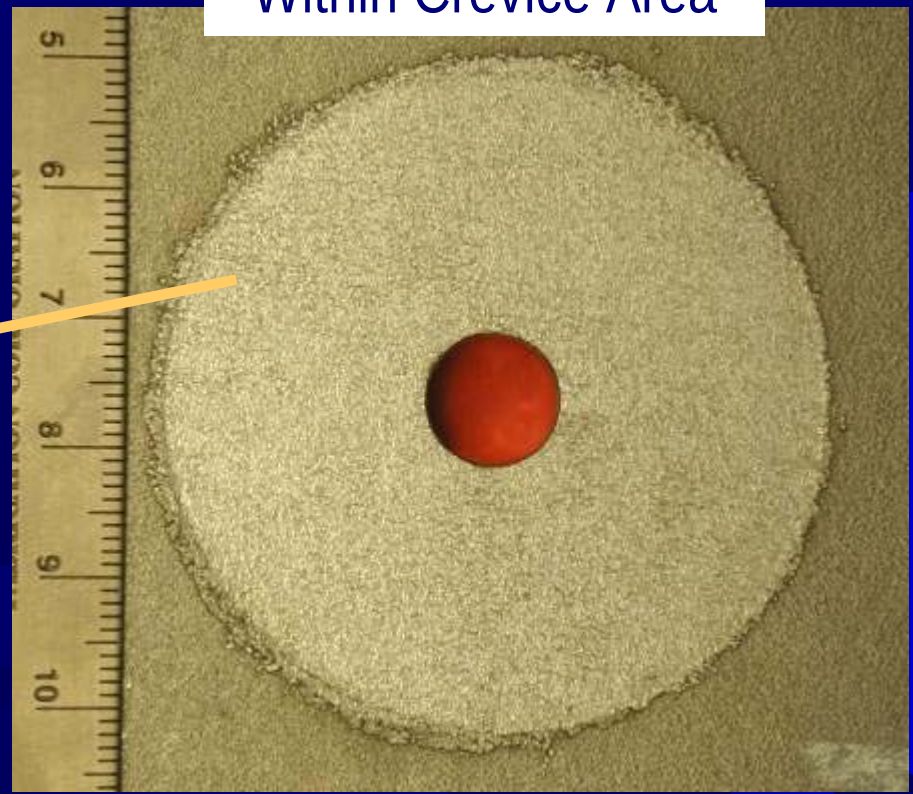
ESD of Ni-Cr-Mo Alloys on Alloy 625



ESD Coating Applied
Within Crevice Area



Crevice Corrosion Testing of ESD Ni-Cr-Mo Alloys on 625

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Crevice Corrosion Testing of ESD Ni-Cr-Mo Alloys on 625

RESULTS TO DATE

- Crevice Panels in Test for 90 Days
- 5 of 6 Crevice Panels Containing ESD C276 in Crevice Area Show Evidence of Corrosion
- Remaining ESD and Control Panels Appear Corrosion-Resistant

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