Efficient Electrochemical Stripping of WC-Co Wear Coatings from Inconel[®] 718 Substrates

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F-110 Turbofan Engines & WC-Co Wear Coatings

- WC-Co “High-Velocity Oxy-Fuel” (HVOF) wear coating on IN718 nozzle panels
- Preventative maintenance requires stripping to allow inspection of substrate
- “Healthy” panels recoated and returned to service

WC-Co HVOF Wear Coatings

- WC particles embedded in a metallic cobalt matrix
- Electrochemical stripping $\rightarrow$ Dissolve Co $\rightarrow$ WC falls away
- Desire RAPID, DAMAGE-FREE coating removal

WC-Co Stripping – Challenges & Goals

- Observed challenges of citrate-percarbonate stripping system
 - Slow: 72-h cycles
 - Ineffective: Aggressive manual scrubbing required
 - Incomplete: Numerous strip/scrub cycles required
 - Unstable: Bath control (pH) is difficult
- Goals
 - Improve speed
 - Fewer, faster cycles
 - Eliminate manual scrubbing
 - Improve bath control
 - NO DAMAGE TO PARTS

Preliminary Investigation

- Significant ambient decomposition of H_2O_2 (Prx)
 - 60%+ depleted within 24 h

- Stripping appears generally *insensitive* to Prx concentration
- No damage observed to IN718 substrate when at specification pH

WC-Co Beaker Stripping Tests

WC-Co Coatings – Pristine vs Aged

Beaker-Scale Apparatus

Stripping of Pristine WC-Co

- All solutions stripped from edges to middle; photos below from stripping test with **Prx-free** solution

Stripping of Aged WC-Co

- Local spallation at coating edges after 210 min
- BUT: Fully stripped within 20 h

WC-Co ElectroCell Stripping Tests

FARADAYIC® ElectroCell Design/Construction

FARADAYIC[®] ElectroCell Apparatus

WC-Co ElectroCell Stripping – Pristine Parts

Run #1

- All pristine parts
- Stripped in low-Prx solution
- Parts cleaned and photographed after 4 h processing

WC-Co ElectroCell Stripping – Pristine Parts

- **Part #1**

- High initial current
- Front fully stripped at 4 h
- Back mostly stripped at 4 h

- **Part #2**

- Low initial current
- Current rise @ ~2 h
- Front edges stripped at 4 h
- Back corners stripped at 4 h

- **Parts #3 & #4**

- Low, ~steady current to 4 h
- Corners slightly stripped at 4 h

WC-Co ElectroCell Stripping – Aged Parts

Run #2

- Pristine parts: #1 & #3
- Aged parts (X): #2 & #4
- Stripped in low-Prx solution
- Parts cleaned and photographed after 4 h processing

WC-Co ElectroCell Stripping – Aged Parts

◇ ElectroCell Run 1

4 Pristine Parts

◆ ElectroCell Run 2

2 Pristine & 2 Aged Parts

ElectroCell Tests – Summary

- All parts (pristine AND aged) stripped completely within 24 h
 - No intensive scrubbing required
- Current distribution significant for stripping performance
 - Parts ‘screened’ from counterelectrode strip much more slowly
 - Aged parts → ***very slow stripping*** if screened from counter-electrode

Racking/Fixturing – Modification Concept

Current Process

Enhanced Process

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Thank You!