

OMIC R&D TECHNOLOGY BOARD

CONCEPTUAL ABSTRACT



TITLE: Spray Coating of Medium Carbon Steel pre-forms to produce economical, sustainable milling cutting tools

RELATED ROAD-MAPPING DESIGNATION ID#: A1

SUPPORTIVE INDUSTRY: Seco Tools, Mitsubishi Materials, Blount, and Sumitomo Electric Carbide.

PROJECT TYPE: General Project – Materials and Alloys

PROBLEM STATEMENT (What Are We Trying to Solve?): Currently a large percentage of cutting tools for are made from WC-Co-Cr (86/10/4). At 10% Cobalt, cutting tools are utilizing a dwindling natural resource that is also a feud material. For cutting tools that are greater than a certain diameter reduction of Cobalt by Cold Spray additive may be a more economical solution for cutting tool creation.

PROJECT DESCRIPTION: Project will test standard 1.00” diameter WC-Co-Cr (86/10/4) endmills against endmills produced utilizing cold spray additive of pre-form or near net blanks. The project will coat medium carbon steel with WC-Co-Cr (86/10/4) however WC-Ni (90/10) or other material suited to wear resistance in endmill applications may also be tested. Process (potentially robotic) for cold spray additive of blanks will need to be created to apply thicknesses ranging from 0.010” – 0.050”. FEA of stiffness will be conducted to create optimal cutting parameters for new endmill with expectation that endmill will flex more in operation. Given the projected reduction of stiffness an analysis for proper use case scenario of the tool would need to be created. Bidder should identify single test application scenario such as profiling in titanium or high feed milling in steel. Cutting tool wear tests will be conducted to compare to standard endmills.

A variety of industry standard methods including but not limited to a Taber Abrasion Test for wear resistance, a Calo Test for coating thickness, a Scrape Test (ASTM D2197) for adhesion, a Micro Vickers Test (ASTM E-384) for hardness, and optical microscopy should be conducted to analyze adhesion between dissimilar metals. Process flow and projected costs will be created to identify how the process could scale and be integrated into companies currently producing cutting tools. This analysis will show at what diameter the process becomes viable.

Identify Related OMIC R&D Resources:

- CNC Machines: ANCA TX7 Linear (Cutting tool grinding) & any CNC Mill (cutting tool testing)

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- Inspection: Zoller Titan (cutting tool inspection of honed edge and geometry), Leica Microscope (cutting tool wear), MTS Load Frame (Destructive testing), and potentially Optical Microscopy equipment if available.

PROJECT DELIVERABLES:

- Process for coating pre-formed medium carbon steel
- Validation of method adhesion qualities including creating a written method for how to conduct this type of cold spray validation
- Tool wear testing including analysis of FEA differences from solid WC-Co-Cr (86/10/4)
- Process flow and projected cost analysis
- Environmental impact evaluation
- All data from tests conducted
- Tools, parts etc. as needed
- Report and Presentation to OMIC Tech Board