COLD SPRAY TOOLING

Cold spray is a type of rapid prototyping that deposits gas atomized molten metal onto a preformed mold. While traveling from the spray nozzle to the mold, the particles cool and many of them solidify. Upon impact with the mold the particles deform, allowing them to bond with the surface. The small size and rapid cooling of the particles allow for a very precise product that, depending on the thickness and composition of the spray layer, can be used to cast permanent dies, recastable dies (such as kirksite), or can be sprayed as permanent die.

RESEARCH

Cold spray differentiates itself from other “thermal spray” techniques via the low temperature of the spray. Other techniques use high temperature molten metal. The metal then adheres to a mold by solidifying onto a surface. Cold spray uses relatively low temperature metal with a mix of solid and liquid particles. The mix of particles adhere to a mold due to their high velocity and slight plasticity.

Cold spray has two distinct energy advantages over other thermal sprays. First, it uses less energy to heat the metal because it operates at a lower temperature. Second, because the metal is at a lower temperature when contacting the mold surface, cold spray can also be applied to almost any surface. This includes 3D printed plastics, or even a balloon. And because it can be applied to plastic molds, thereby skipping a few steps in the development process, the development time and energy for a prototype is drastically reduced.

Cold spray has several advantages over standard die cast manufacturing. First, it uses significantly less energy than standard die cast manufacturing methods. There is no need for a steel mill to produce metal plates or rods, there is no machining, and cold spray is aged at a much lower temperature than standard metals. Cold spray also creates dies that last 25% longer than standard due to their refined grain structure.

INTELLECTUAL PROPERTY


PROJECT GOALS

The Ohio State University is seeking industry partners who would benefit from this novel surface coating. The Center for Design and Manufacturing Excellence (CDME) will work with partners to develop novel systems for rapid recasting and agile tooling creating dies. CDME will look for industry partners who would like to implement these in their applicable markets. The goal of this program is the active commercialization of a series of durable and effective cold spray tools.

INVENTORS

Kevin M. McHugh is a senior research scientist in materials procession at Idaho National Laboratory. He received his degree at John Hopkins University and is passionate about discovering and developing new products and processes. He has experience as a research scientist with hands-on skills in designing and building test equipment, designing experiments, writing proposals and scientific journals in many areas of material science.

Idaho National Laboratory (INL) is part of the U.S. Department of Energy’s complex of national laboratories. The laboratory performs work in each of the strategic goal areas of DOE: energy, national security, science and environment. INL is the nation’s lead laboratory for nuclear energy research, development, demonstration, and deployment. It is engaged in the mission of ensuring the nation’s energy security with safe, competitive and sustainable energy systems and unique national and homeland security capabilities.
RECOGNITION

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PROGRAM MANAGER

It is proposed that Dr. Glenn Daehn, Materials Science Engineering Professor, and Nate Ames, Engineering Manager for CDME, will lead this project for CDME.

Dr. Glenn Daehn is a Professor in the Materials Science & Engineering (MSE) Department at The Ohio State University. He has established himself as the Fontana Professor of Metallurgical Engineering since joining the university in 1987, and is the Executive Director for the Honda-OSU Partnership Program. Daehn’s research fields of expertise include state-of-the-art materials processing and manufacturing, welding engineering, and property relationships in materials. Dr. Daehn graduated with honors from Northwestern University in 1983 and earned his MS and PhD degrees from Stanford University in 1987, all in MSE.

Nate Ames has a Bachelor’s and Master’s Degree in Welding Engineering from OSU and has been an inventor on several issued patents. Prior to joining CDME, Mr. Ames’ previous work experience includes various industry positions where he has been involved in the design and implementation of engineering solutions. He spent 5 years as a New Product Development engineer for Swagelok Company and 11 years at EWI where he led several departments, including Engineering Manager of the Material Science Department and Technical Director. Mr. Ames is the co-inventor of the patent-pending improved design of the circular wave drive and has a very firm understanding of the capabilities of the gear and its application across a myriad of industries.

KEY FEATURES AND BENEFITS

• An alternative to manufacture molds and dies
• Can be used to fabricate tooling with micro-scale surface features
• Improved water repellency
• Customizable based on application and need
• Intellectual property protection pending

THE OHIO STATE UNIVERSITY

CDME is supporting the commercialization of technologies that emerge from Ohio State’s annual research efforts. Ohio State has one of the largest research and development budgets of all universities. The amount of annual funding is a leading indicator of the breakthrough innovation occurring within the University. Recent annual highlights from OSU:

> $934 Million: Total research and development (R&D) expenditures
> $470 Million: Federal R&D expenditures
> $101 Million: Industry-sponsored research expenditures

Whether your interest is in licensing, sponsored research, joint ventures, investment, corporate giving or placement of our best students, Ohio State is here to help accelerate your business through innovation.

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