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Industrial News

CTSR Welcomes Three New Member Companies to Its Research Consortium

Stony Brook University's Center for Thermal Spray Research (CTSR) is proud to announce the addition of three new member companies to its Consortium on Thermal Spray Technology: Northwest Mettech Corporation, Stellite Coatings, and VTT Manufacturing Institute, Finland. These companies bring a wealth of industrial expertise to the group in the arenas of equipment manufacturing, coating application, and research/development.

The Consortium on Thermal Spray Technology was founded in 2001 on the premise that thermal spray (TS) technology offered a perfect platform for precompetitive, collaborative projects between end-users (OEMS), applicators, material and equipment developers, and leading research institutions. The Consortium was a logical evolution from a $10 M National Science Foundation (NSF)-funded Materials Research Science and Engineering Center program, which allowed significant enhancements in fundamental science and applied engineering of TS technology. The Consortium has not only enabled knowledge transfer from the Center to the industry but, through combined resources and expertise, the group has tackled issues of material design, process diagnostics, optimization, and reliability. Major outcomes of the consortium efforts include development of advanced process maps, new methods of coating characterization, and an integrated approach to process and materials development. The initial work focused on thermal barrier coatings (TBCs), and more recently the work has been expanded to include high-velocity oxyfuel (HVOF) processing of cemented carbides and other systems. Future work will continue to develop these themes into expanded materials applications and also to link the process science efforts to performance and lifetime predictability of high-temperature ceramics including TBCs, fuel cells, and abradables.

Close to 20 companies participate in the Consortium including General Electric, Siemens, Honeywell, Caterpillar, Mitsubishi Power Systems, Solar Turbines, Plasma Technology Inc., Army Research Lab, Tinker Air Force Base, Kennametal, BASF (formerly Engelhard), Osram Sylvania, Praxair, St. Gobain, Sulzer Metco, and Applied Materials. The Consortium also provides a mechanism to access federal research programs that are of joint interest between company partners and the university and allows exploration of future novel TS applications, such as in functional surfaces, electronics, and multilayers. Access to cutting edge advanced characterization facilities is also provided through the network of premier research institutions that partner with the CTSR.

The annual research agenda is set by the membership and the Center based on relevant themes and capabilities, and meetings are held throughout the year to keep the group up to date on status and achievements made. Annual training workshops and classes are also held to keep the group abreast of the latest advances being made not only in TS, but also in surface engineering in general.

The Consortium received a major boost from NSF in 2006 through a ~$1 M focused research group program to continue to build the university-industry linkages and to develop new educational initiatives. The State University of New York has also contributed significantly to the Center through the establishment of a new 10,000 sq ft facility.

The Center for Thermal Spray Research welcomes industrial participation in all aspects of our activities from sharing in research results to funded programs in specific study areas. Extensive facilities are available for exploratory research, materials processing, product development, and materials testing. Information on the CTSR activities and research updates are available through a Center Newsletter and the World Wide Web.

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News from Naval Research Laboratory

Plasma Spray Coating as an Alternative to Chromium Plating

Plasma spray application of coating materials that include tungsten carbide has been investigated as an alternative to electroplating of hard chromium onto internal metal surfaces that are required to be protected against wear or to be restored to within dimensional tolerances. Prime examples of such wear surfaces are the inner walls of cylinders in aircraft hydraulic actuators and dampers. The need for an alternative to chromium plating arises partly because chromium plating involves the use of hexavalent chromium, which is a highly toxic carcinogen subject to increasingly stringent government regulation and, therefore, increasingly expensive to use. Another reason for developing an alternative arises from a desire to reduce process time: To remove hydrogen that is unavoidably incorporated during chrome plating, it is necessary to perform a 24 h bakeout. Process time could be reduced substantially if this bakeout could be eliminated. Plasma spraying involves fewer process steps than does electroplating, and for plasma sprayed coatings, no hydrogen bakeout is necessary.

What makes it feasible to consider plasma spraying of carbides as an alternative to chrome plating is the recent commercial development of miniature plasma spray guns. The limitations of the process are primarily the minimum inner diameter and the maximum axial length that can be coated. For a given plasma gun, the minimum coatable inner diameter is defined by the size of the gun plus the standoff (the required distance between the gun and the surface to be coated). The maximum coatable axial length is ordinarily determined by the length of an extension that carries the gun; however, if the extension is too long, the extension and gun assembly is not mechanically stable enough to be moved and operated with the necessary precision.

The coating materials investigated included a WC/Co mixture, two slightly

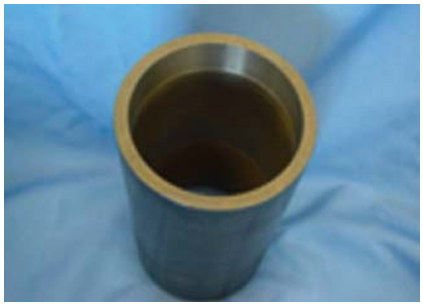

Fig. 1 Steel cylinder, a 3 in. (7.62 cm) inside diameter, coated on the inside by plasma spraying of a WC/Co mixture incorporating a nickel-base self-fluxing alloy. At one end, the coating was ground with a diamond wheel in a test of finishing techniques

different WC/Co mixtures incorporating a nickel-base self-fluxing alloy (Fig. 1), a Co/Mo/Cr/Si alloy, and aWC/CrC/Ni mixture. In tests, the sliding and abrasive wear performances of the plasma sprayed carbide-based materials were found to be, variously, equivalent or superior to those of electroplated hard chromium. Electrochemical corrosion measurements revealed corrosion performances inferior to those of electroplated hard chromium, indicating that these materials are not suitable for use in high-corrosion environments. However, they are well suited for such low-corrosion environments as the interiors of hydraulic dampers and actuators.

As part of the investigation, a cost analysis of plasma spraying of carbide coatings versus chrome plating was performed. It was found that for cylinders having diameters of 4 in., in which larger plasma spray guns can be used, the cost of plasma spraying is comparable to that of electroplating of hard chromium. For smaller diameters, the cost of plasma spraying was found to be somewhat greater than that of chrome plating. However, in some applications, the greater cost of plasma spraying might be justified by the reduction in process time.

Adapted from ***Defense Technical Briefs,*** *Feb 1, 2007. This work was done by Keith O. Legg of the Rowan Technology Group; Bruce D. Sartwell and Jean-Gabriel Legoux of the National Research Council Canada; Montia Nestler and Christopher Dambra of Sulzer-Metco; Daming Wang and John Quets of Praxair Surface Technologies; Paul Natishan of the Center for Corrosion Science; Philip Bretz of Metcut Research Inc.; and Jon Devereaux of the Naval Air Depot of Jacksonville, FL, for the Naval Research Laboratory. For further information, download the free white paper at www.defensetechbriefs.com under the Materials category. NRL-0002.*

News from TSS

Awards for Thermal Sprayers

Society members always get a feeling of satisfaction when they see that deserving members are receiving their appropriate rewards. ASM and TSS have several awards to recognize special accomplishments, and the TSS Awards Committee is encouraging nominations for ASM and TSS awards. You can help us to make sure that no deserving TSS member is overlooked by sending us detailed information about this member (this may include yourself) and his/her accomplishments. We will select an appropriate award and look for a champion to prepare the nomination.

Contact: Joachim Heberlein, Chair TSS Awards Committee, e-mail: jvrh@me.umn.edu.