

BOOK REVIEW

Thermal Spray: International Advances in Coatings Technology, Proceedings of the 13th International Thermal Spray Conference, 28 May - 5 June, 1992, Orlando, Florida, USA

These proceedings cover the panorama of current investigative work in the thermal spray field. Coverage is worldwide; about 40% of the papers originated from North America, and about 30% each from Asia and Europe. The following themes predominate throughout this book:

- Improved theoretical understanding of the thermal spray process
- Improved reliability and reproducibility, with the aid of automation, sensors, tests, and statistical methods
- Expanding nonaerospace applications in industries such as automotive, biomedical, electronics/electrical, chemical processing (including petroleum), and pulp and paper
- Proliferation of HVOF systems and applications

Although the papers are grouped to a certain extent by topic, readers of a 1000+ page book also expect topical section headings, which were omitted here from both the table of contents and the text. The three excellent indexes—by authors, by company and institution, and by keywords and key phrases—are welcome.

The submission of camera-ready papers for publication has led to mixed results. The text was generally well organized, legible, and written in acceptable English. However, many of the graphs and photographs were too small or too washed-out to deliver their full messages. The authors and publishers should cooperate to solve this figure problem, which is not new.

The papers vary widely in their technical complexity and use of mathematics. Several will be understandable only to professors in specialized fields. The majority, however, convey useful information to any technically literate reader who knows the rudiments of thermal spray.

Although the papers selected for this volume were all reviewed and edited (some offerings were even rejected), they were not examined in the same detail as archival *JTST* articles. Authors were basically held responsible for accuracy. Readers who find serious errors of fact should be encouraged to send letters to *JTST* with their own evidence!

There are many highlights among the papers; the reviewer has selected ten papers to suggest the flavor of this volume:

C.C. Berndt, Editor

Pub. in 1992 by ASM International®
Materials Park, OH, USA

Hard bound, 1044+ pages, Letter page format (22 cm x 28.5 cm). ISBN: 0-87170-443-9. SAN: 204-7586. Price is \$84.00 to ASM International members and \$105.00 to non members.

“Diagnostics and Sensor Development for Thermal Spray Technologies,” J.R. Fincke, p 1-9. This paper is an overview of the measurement techniques needed for process optimization and control. An analysis of plasma temperature measurement reveals that conventional emission spectroscopy techniques may give misleading results. The implications of rapid fluctuation of the plasma jet are also discussed.

“A Pragmatic Analysis and Comparison of the HVOF Process,” M.L. Thorpe and H.J. Richter, p 137-147. This paper offers a scientific basis for the known advantages of the HVOF spray process. Theory (combustion, fluid mechanics, heat transfer, etc.) and test data are brought together in a well-organized fashion. The historical evolution of HVOF devices is also discussed. Gun designs are compared with respect to performance, but in-depth supporting evidence is not provided.

“High Velocity Oxy-Fuel Flame Spraying of Molybdenum,” H. Kreye and D. Blume, p 177-180. Elemental molybdenum powder would not be expected to melt significantly during its brief passage through the HVOF jet, especially when the fuel is propane. However, the presence of the lower melting Mo-MoO₂ eutectic phase, either from the starting powder or from oxidation in flight, greatly enhances particle melting.

“High Temperature Stability of Titanium Aluminide Matrix Composites Fabricated by Reactive Low Pressure Plasma Spraying,” Y. Tsunekawa, *et al.*, p 189-194, and **“Spraying of TiN by a Combined Laser and Low Pressure Spray System,”** A. Ohmori, *et al.*, p 201-206. These well-documented studies both discuss controlled compound formation during spraying. *In situ* composites show great promise as strong, lightweight structural materials.

“Fusing of Sprayed Ni-Base Coatings by Induction Heating,” N. Takasaki, *et al.*, p 273-278. Although induction fusion of self-fluxing alloys (nickel-base braze alloys) has been practiced at Battelle and elsewhere, very little about the technique has been published. The authors describe a process for oxy-fuel spraying followed by induction fusion, which is suitable for hardfacing large rolls.

“The High-Volume Production of Plasma Spraying Dielectric Coatings,” T. Peterman, p 309-320. Ford Motor Co. is depositing alumina coatings onto alternator parts using an

automated, high-volume system for parts handling, surface preparation, coating, and post treatment. The results illustrate the high reliability of modern spray systems.

"Advanced Thermal Barrier Coatings Involving Efficient Vertical Micro-Cracks," H. Nakahira, *et al.*, p 519-524. New thermal barrier coating materials based on combinations of 2CaO-SiO and CaO-ZrO resist hot corrosion by 85% V₂O₅/15% Na₂SO₄ ash as well as thermal shock. Reaction products of initial hot corrosion suppress further corrosion. Microcracks suppress spalling during thermal cycling.

"Application of HVOF Thermal Spraying to Solve Corrosion Problems in the Petroleum Industry," L.N. Moskowitz, p 611-618. An inert gas-shrouded HVOF gun deposits high density, low-oxide coatings of corrosion-resistant alloys, such as type 316L stainless steel and Hastelloy C-276. The entire chemical process industry can benefit from coatings impervious to process gases and liquids. Until now, only low-

pressure plasma spray has been able to eliminate porosity to the degree required.

"Thermal Coating Development for Impulse Drying," W.J. Lenling *et al.*, p 619-629. Partially stabilized zirconia layers with controlled porosity levels help heated impulse drying rolls to remove moisture from sheets of linerboard, a heavyweight paper.

All current and would-be thermal spray practitioners and investigators would benefit from reading this cross section of current technology. It belongs in every Engineering Department library, whether in the academic world or in industry.

Reviewed by:

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