

## Preface

This volume contains the proceedings of the International Thermal Spray Conference 2006 (ITSC 2006) held in Seattle, Washington, May 15–18, 2006. More than 250 papers covering the full spectrum of topics on the science of, innovations in, and applications for thermal spray are presented in this volume. The contributions feature a broad range of topics, including recent progress in the basic science of spraying, diagnostics, process control, particle impact, microstructure, and properties; results on degradation mechanisms, testing and performance evaluation; and developments in new materials, processes, equipment and applications. Papers from three focused symposia on coatings for biomedical applications, cold spray, and modeling and simulation highlight some of the advances in these areas. In short, this collection of papers presents a snapshot of the current state of advancement of the thermal spray field.

The submissions contained within this volume have all passed through a formal review process. All abstracts were reviewed by the ITSC-2006 Program Organizing Committee. The people who sit on the Program Organizing Committee are listed in these proceedings. At this initial stage, the 200-word abstracts were assessed by a committee of international experts. The abstracts were checked for overall scientific and engineering content so a decision could be made concerning whether the corresponding author could be invited to submit a full manuscript. It was necessary for such manuscripts to follow strict guidelines in regard to format, editorial style, quality and standard of scientific and technical content. The prime restriction placed on the authors was to maintain their contribution to within six pages. All manuscripts were reviewed by the team of editors and a decision made concerning the quality of the manuscript and its acceptance or rejection. In summary, all of the papers within the ITSC-2006 Proceedings were reviewed according to established, high-quality guidelines.

Many individuals have contributed to the successful completion of this work. We thank the authors for choosing this venue to share their research results and insights with their peers. We are indebted to Sylvie Lamontagne of the Industrial Materials Institute, National Research Council of Canada for her tireless efforts in addressing issues related to formatting and patiently working with us to process the 1500 pages of text, tables and figures. And finally, completion of this work would not have been possible without a strong commitment from our employers, the Industrial Materials Institute, National Research Council of Canada; The University of Auckland; GE Global Research; and the Austrian Research Centers — Leichtmetallkompetenzzentrum Ranshofen, to support this endeavor by providing the resources required to accomplish this task.

To everyone involved, we express our sincere thanks.

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# Conference History

## **1st National Thermal Spray Conference** (1987) September 14–17, Orlando (FL)

Reference: “Thermal Spray: Advances in Coatings Technology,” Ed. D.L. Houck, Pub. ASM International, Materials Park, OH, USA, 1988, 426+ pages. ISBN: 0-87170-320-3. 59 papers published and 730 attendees.

## **2nd National Thermal Spray Conference** (1988) October 24–28, Cincinnati (OH)

Reference: “Thermal Spray Technology — New Ideas and Processes,” Ed. D.L. Houck, Pub. ASM International, Materials Park, OH, USA, 1989, 469+ pages. ISBN: 0-87170-335-1. 61 papers published and 1300 attendees.

## **3rd National Thermal Spray Conference** (1990) May 20–25, Long Beach (CA)

Reference: “Thermal Spray Research and Applications,” Ed. T.F. Bernecki, Pub. ASM International, Materials Park, OH, USA, 1991, 792+ pages. ISBN: 0-87170-392-0. 110 papers published and 1600 attendees.

## **4th National Thermal Spray Conference** (1991) May 4–10, Pittsburgh (PA)

Reference: “Thermal Spray Coatings: Properties, Processes and Applications,” Ed. T.F. Bernecki, Pub. ASM International, Materials Park, OH, USA, 1991, 556+ pages. ISBN: 0-87170-437-4. 79 papers published and 1300 attendees.

## **13th International Thermal Spray Conference** (1992) (5th National Thermal Spray Conference — 1992) May 28 – June 5, Orlando (FL)

Reference: “Thermal Spray: International Advances in Coatings Technology,” Ed. C.C. Berndt, Pub. ASM International, Materials Park, OH, USA, 1992, 1044+ pages. ISBN: 0-87170-443-9. 161 papers published and 1600 attendees.

## **6th National Thermal Spray Conference** (1993) June 7–11, Anaheim (CA)

Reference: “Thermal Spray: Research, Design and Applications,” Ed. C.C. Berndt and T.F. Bernecki, Pub. ASM International, Materials Park, OH, USA, 1993, 691+ pages. ISBN: 0-87170-470-6. 105 papers published and 1250 attendees.

## **7th National Thermal Spray Conference** (1994) June 20–24, Boston (MA)

Reference: “Thermal Spray Industrial Applications,” Ed. C.C. Berndt and S. Sampath, Pub. ASM International, Materials Park, OH, USA, 1994, 800+ pages. ISBN: 0-87170-509-5. 126 papers published and 1500 attendees.

## **8th National Thermal Spray Conference** (1995) September 11–15, Houston (TX)

Reference: “Thermal Spray Science & Technology,” Ed. C.C. Berndt and S. Sampath, Pub. ASM International, Materials Park, OH, USA, 1995, 774+ pages. ISBN: 0-87170-541-9. 126 papers published and 1200 attendees.

## **9th National Thermal Spray Conference** (1996) October 7–11, Cincinnati (OH)

Reference: “Thermal Spray: Practical Solutions for Engineering Problems,” Ed. C.C. Berndt, Pub. ASM International, Materials Park, OH, USA, 1996, 992+ pages. ISBN: 0-87170-583-4. 131 papers published and 1350 attendees.

## **10th National Thermal Spray Conference** (1997) September 14–18, Indianapolis (IN)

Reference: “Thermal Spray: A United Forum for Scientific and Technological Advances,” Ed. C. C. Berndt, Pub. ASM International, Materials Park, OH, USA, 1997, 1020+ pages. ISBN: 0-87170-618-0. 137 papers published and 950 attendees.

## **15<sup>th</sup> International Thermal Spray Conference** (1998) May 25–29, Nice, France

Reference: “Thermal Spray: Meeting the Challenges of the 21<sup>st</sup> Century,” Ed. C. Coddet, Pub. ASM International, Materials Park, OH, USA, 1998, 1693+ pages. ISBN: 0-87170-659-8. 272 papers published.

**2<sup>nd</sup> United Thermal Spray Conference** (1999) March 17–19, Dusseldorf, Germany

Reference: “Tagungsband Conference Proceedings” Ed. E. Lugscheider, P. A. Kammer, Pub. DVS-Deutscher Verband für Schweißen, Germany, 1999, 879+ pages. ISBN 3-87155-653-X. 170 papers published

**1<sup>st</sup> International Thermal Spray Conference** (2000) May 8–11, Montréal, Québec, Canada

(The first ITSC sponsored by the ASM-Thermal Spray Society, The DVS-German Welding Society, and the IIW-International Institute of Welding)

Reference: “Thermal Spray: Surface Engineering via Applied Research,” Ed. C.C. Berndt, Pub. ASM International, Materials Park, OH, USA, 2000, 1383+ pages. ISBN 0-87170-680-6. 199 papers published and 1068 attendees

**International Thermal Spray Conference** (2001) May 28–30, Singapore

Reference: “Thermal Spray 2001: New Surfaces For A New Millennium,” Ed. C.C. Berndt, K.A. Khor, E. Lugscheider, Pub. ASM International, Materials Park, OH, USA, 2001, 1361+ pages. 185 papers published

**International Thermal Spray Conference** (2002) March 4–6, Essen, Germany

Reference: “Tagungsband Conference Proceedings,” Ed. E. Lugscheider, Pub. DVS-Deutscher Verband für Schweißen, Germany, 2002, 1051+ pages. ISBN 3-87155-783-8. 202 papers published

**International Thermal Spray Conference** (2003) May 5–8, Orlando, Florida

Reference: “Thermal Spray 2003: Advancing the Science and Applying the Technology,” Ed. B.R. Marple, C. Moreau, Pub. ASM International, Materials Park, OH, USA, 2003, 1708+ pages. ISBN 0-87170-785-3. 244 papers published

**International Thermal Spray Conference** (2004) May 10–12, Osaka, Japan

Reference: “Thermal Spray 2004: Advances in Technology and Application,” Ed. B. R. Marple, C. Moreau, Pub. ASM International, Materials Park, OH, USA, 2004, 1118+ pages. ISBN 0-87170-809-4. 207 papers published

**International Thermal Spray Conference** (2005) May 2–4, Basil, Switzerland

Reference: “Thermal Spray Connects: Explore its Surfacing Potential!” Ed. E. Lugscheider, Pub. DVS-Verlag GmbH, 40223 Duesseldorf, Germany, 2005, 1574+ pages. ISBN 3-87155-793-5. 328 papers published

**International Thermal Spray Conference** (2006) May 15–18, Seattle, Washington