In The News

New Literature

Heat Treating Proceedings of the 16th Conference

Heat Treating Proceedings of the 16th Conference, covering what has become one of the preeminent heat treating conference and expositions in the world, is now available from ASM International. For the first time, this event was conducted under the auspices of the ASM Heat Treating Society. A separate affiliate of ASM International, it was established in recognition of the ever-growing importance of heat treating.

The objective of this 16th conference is the same as all the prior gatherings—"to determine what information you, as heat treaters and customers of heat treating, need most ... and to provide it." Information is presented that can help readers become more competitive and successful in the marketplace. This 700-page book shows how ASM, MTI, and the U.S. Department of Energy are working together to benefit the entire heat treating industry. "We're proud to provide coverage of the foremost heat treating conference in North America," states Bill Scott, Technical Director at ASM. "We feel this book provides the most thorough look at the future of heat treating."

Co-editor John Dossett is president of Midland Metal Treating, Inc. in Franklin, WI. The other co-editor, Robert Luetje, works for Kolene Corporation in Detroit, MI. Contents include: Quenching and Cooling, Diffusion-Related Processes, Vacuum, Powdered Metal, Steel Transformations, Russian Technology, Plasma Processing, Furnaces, Salt Bath Heat Treating, Induction, Aluminum Alloys, Resource Management, Internal Quality and Microstructures, Instrumentation/Quality System, Endothermic Generators, Distortion, and SPC.

Heat Treating Proceedings of the 16th Conference is available for $140.00 (ASM members $112.00). To order, contact ASM Member Services Center, Materials Park, OH 44073-0002; tel: 800/336-5152, ext. 900 (U.S. only) or 216/ 338-5151, ext. 703; fax: 216/338-4634.

ASM Handbook on Fatigue and Fracture

The first reference book to combine critical information on fatigue and fracture mechanics in a single volume will join the authoritative line of *ASM Handbooks* in September 1996. *Fatigue and Fracture,* Volume 19 in the *ASM Handbook Series,* will provide comprehensive information and data on a broad spectrum of engineering structural materials and alloys, including most common alloys, cast and wrought metals, weldments, aluminum and titanium alloys, superalloys, and other engineered materials.

To help users make more informed decisions that can result in the life extension of components, the new *Handbook* provides essential information and data on alloy design, heat treatment, material and process selection, and lubrication. "For the past two-and-a-half years, our goal has been to create a new reference work that would become an absolute must for metallurgists, component designers, mechanical engineers, materials scientists and engineers, and engineering students," said Bill Scott, ASM Technical Director. "To this end, *Fatigue and Fracture* has been written and compiled by nearly 100 leading international authorities, then refined by the exhaustive peer review process unique to *ASM Handbooks.*"

Besides presenting information from a practical, "how-to" viewpoint, the new book also provides insights into the fundamental "whys" of fatigue and fracture. Volume 19 also covers mechanisms, testing, analysis and characterization materials; gives valuable insights into fracture control, life assessment and failure analysis; and describes the use of fatigue and fracture properties in actual engineering practice. Appendices on fatigue strength parameters and stress-intensity factors are provided for fast reference.

In total, *Fracture and Fatigue* comprises more than 950 pages divided into the following broad sections:

- Fatigue Mechanisms
- Crack Growth
- Testing
- Engineering Aspects of Fatigue Life
- Fatigue and Fracture Control
- Castings
- Weldments
- Wrought Steels
- Aluminum Alloys
- Titanium Alloys
- Superalloys
- Other Structural Alloys
- Solders
- Advanced Materials

Regular price of the new *Handbook* is $153.00 (ASM member: $122.40). Special prepublication price until 30 Sept 1996 is $134.00 (ASM member: $107.20). Order No. 6197NR. Contact: ASM Member Services Center, Materials Park, OH 44073-0002; tel: 216/338-5151, ext. 300; fax: 216/338-4634; e-mail: mem-serv@po.asm-intl.org.

MC95—Proceedings of the International Metallographic Conference

The *Proceedings of the International Metallographic Conference* held in Colmar, France, is now available from ASM

International. This 456-page guide presents an impressive collection of oral and poster session presentations made at an industry conference organized by ASM International Europe and cosponsored by the International Metallographic Society. Scientists and engineers, representing 26 countries, were shown a very broad range of subjects including a full array of ferrous alloys, a number of nonferrous metals and alloys, coating systems, ceramic materials, and electronic alloys.

Other topics covered: New Microscopical Techniques, Advancements in Metallographic Specimen Preparation, Microscopical Study of Coatings, Fractographic and Failure Analysis Studies and Case Histories, Quantitative Microscopy, Fractal and Image Analysis Techniques and Applications, and Studies of the Interplay between Microstructure, Processing and Materials Behavior.

MC95—Proceedings of the International Metallographic Conference is available for $108.00 (ASM members $86.40). To order, contact ASM Member Services Center, Materials Park, OH 44073-0002; tel: 216/ 338-5151, ext. 900; fax: 216/338-4634. Refer to order #6359NR.

Microstructural Science, Volume 23

Microstructural Science, Volume 23, *Advances and Applications in the Metallography and Characterization of Materials and Microelectronic Components,* which covers the proceedings of the 28th Annual Technical Meeting of the International Metallographic Society, is now available from ASM International. This 316-page resource guides the reader through the intricacies of tailoring microstructures in silicon nitride ceramics to make them more reliable when used as engineering components. Also, in an overview of phase transformations and their metallography, there's a detailed explanation of shape memory alloy effects.

"We're very proud to say that renowned metallographers, metallurgists and materials scientists from 10 different countries contributed to these very important proceedings," states Bill Scott, Technical Director at ASM.

Contents include: Behavior of Nonmetallic Materials and Devices, Behavior of Nonferrous Metals, Failure Analysis of Microelectronic Packages and Devices, Structure/Property Relationships for Iron and Steel, Steel Failure at High Temperatures, Sample Preparation for Metallography and Other Purposes, Applied Microscopy and Image Analysis, Behavior in Novel Applications, and Microelectronic Characterization.

Microstructural Science, Volume 23, *Advances and Applications in the Metallography and Characterization of Materials and Microelectronic Components* is available for $108.00 (ASM members $86.40). To order, contact ASM Member Services Center, Materials Park, OH 44073-0002; tel: 216/338-5151, ext. 900; fax: 216/338-4634. Refer to order #6065NR.

Emerging Technologies and Opportunities—Supertough Coatings

Supertough Coatings: Expanding the Performance of Conventional Materials is available from Technical Insights, Inc. Contact: Technical Insights, Inc., Dept. JU2196, P.O. Box 1304, Fort Lee, NJ 07024-9967. Price: $1200. (additional copies, each at $300, applicable only with initial order).

Effect of Surface Coatings and Treatments on Wear

Effect of Surface Coatings and Treatments on Wear (STP 1278) features the latest research on hard coating tribological behavior. In addition to a comprehensive overview of surface treatment and coating processes, as well as numerous wear processes, this unique volume presents cutting-edge information on:

- Self-lubricating ceramic coatings
- The impact of laser treatment on coating structure and hardness
- Three variations of hard coating fretting results
- Laboratory models for fretting testing
- The use of thermally stable compounds as high temperature ceramic lubricants
- Efficient methods for handling the effect of hard coatings on light alloys
- The elastic, plastic, and cracking properties of various plasma sprayed coatings
- The preparation of a high temperature synthesis process coating technique

This is an invaluable resource for materials engineers and researchers, applied mechanics engineers, and research and design specialists in the mechanical engineering field. 166 pages (1996); soft cover; $69 List; $62 ASTM Members, Order #: PCN 04-012780-27.

NACE Publications for Materials and Corrosion Engineers

The *Proceedings of the Corrosion/96 Research Topical Symposia* (sponsored by the NACE Research Committee, F.P. Ford, Chairman; R. Baboian, Vice Chairman) features a collection of 16 papers from two research symposia held at CORROSION/96 in Denver, CO: Part I—Life Prediction of Structures Subject to Environmental Degradation and Part II—Crevice Corrosion: The State of the Science and its Control in Engineering Practice. These proceedings address topics specific to the above subjects, including: conceptual understanding and life prediction of pipeline steels; coupled environment fracture model of cracking; design and testing in relation to life prediction; crevice corrosion, past, present, and future; electrochemical considerations; surface treatment for crevice corrosion control. ($67 List, $47 NACE Member, Item No. 37396).

Reviews on Corrosion Inhibitor Science and Technology, Volume 2 (edited by A. Raman and P. Labine) features 18 papers from the CORROSION/96 symposium sponsored by the NACE Task Group T-3A-15. It includes new topics involving corrosion inhibitor (CI) science and technology. New topics include: synergism in mixed inhibitor applications, inhibition and cathodic protections, heterocyclic inhibitors for sulfuric and naphthenic acids and other topics. ($90 List, $69 NACE Member, Item No. 37395).

Corrosion in the Water and Waste Water Industries (edited by M. Szeliga) provides readers with a broad range of information about many of the corrosion concerns related to infrastructure. It includes 46 technical papers. Topics in-

clude: internal corrosion, treatment storage facilities, ductile iron piping, concrete piping, copper piping, asbestos cement piping, and zebra mussels. ($127 List, $97 NACE Member, Item No. 37544).

Control of Corrosion on the Secondary Side of Steam Generators (edited by R. Staehle) features 41 papers from 10 sessions of an Oct 1995 conference sponsored by the Electric Power Research Institute (EPRI) and Argonne National Laboratory. Topics covered include: modes and submodes of stress-corrosion cracking (SCC), metallurgical definition, initiation and growth of SCC, local chemistry and electrochemistry, relationship between bulk and local chemistry, modeling and prediction for occurrence and minimization: stepwise approach and critical elements, and research priorities. ($97 List, $80 NACE Member, Item No. 37398).

These titles are available by contacting NACE Membership Services at 713/492-0535, ext. 81.

SSPC Announces New Edition of Systems and Specifications

In response to technological and regulatory developments affecting the protective coatings industry, the Steel Structures Painting Council (SSPC) has revised its *Steel Structures Painting Manual,* Volume 2, *Systems and Specifications.*

Systems and Specifications is a complete collection of all SSPC specifications, commentaries, guides, and procedures for the cleaning and painting of structural steel. The new 7th edition introduces a number of new and revised standards, including a guide on methods for improved performance, guides on environmental compliance, and several newly developed performance-based paint specifications. This edition also includes revised abrasive blast cleaning specifications and a new technology report on thermal cleaning, which have been issued as joint standards by the SSPC and NACE (National Association of Corrosion Engineers) International.

Also, due to the potential and known hazards stemming from the use and removal of lead-containing paint, all paint and painting system specifications that either contain lead or call for the use of lead-containing paints have been withdrawn from this edition.

Volume Two, *Systems and Specifications,* is a companion to Volume One, *Good Painting Practice,* an encyclopedia of methods, equipment, and systems for painting steel. The most recent edition of *Good Painting Practice* contains several chapters not found in previous editions that discuss safety and health in the protective coatings industry and environmental regulations affecting the use of protective coatings.

If purchased separately, *Systems and Specifications* and *Good Painting Practice* each sell for $100; however, if purchased together as a set, the combined price is $175. For more detailed information contact SSPC's publications office; tel: 412/281-2331; fax: 412/281-9992.

Electronic Media

ASM MetalWorks Store

Identifying and ordering the right book or software to solve a metals problem is now easier with the debut of the ASM MetalWorks Store at http://www.asm-int.org. "This online book and software store on the World Wide Web offers several advantages over printed catalogs," said Leslie H. Chom, ASM manager for electronic marketing. "Through the ASM MetalWorks Store, we're able to present information on our products and services in greater detail, while communicating new developments with an immediacy that can't be matched by printed materials."

As requested by visitors to the site, the ASM MetalWorks Store provides a table of contents for nearly every book in the ASM collection. In addition, for ease of use, all of the store's contents are searchable by keyword. After typing keywords of interest, such as "aluminum fatigue" or "wear or tribology," visitors receive listings of all ASM books containing those words. Visitors may also browse the store via broader subjects. For example, click on "corrosion" to find all ASM books in this area. Click on a title to find the author's name, ISBN number, publication year, publisher, number of pages, a description of the book, and prices. Then, a final click provides the book's table of contents. Orders may be placed via phone, fax, mail or e-mail to the ASM Member Services Center.

"Response to the ASM MetalWorks Store has been very encouraging," Chom said. "Many ASM members and customers in different time zones have discovered that having the option to shop 24 hours a day, 7 days a week, can be quite a convenience." Similar to real stores at shopping malls, the ASM MetalWorks Store provides for hospitality and entertainment. For example, visitors are invited to sign a guest book and given a chance to win one of ASM's popular *Desk Edition Handbooks.*

New products, information, news, and features are added weekly to the ASM home page at http://www.asm-intl.org. Visitors may download demos of ASM software products; browse special "online-only" book sales; preview upcoming products, events, and attractions; search the archives of ASM technical journals; and take sample lessons from ASM's collection of Materials Engineering Institute continuing education courses.

For more information about the ASM MetalWorks Store and the ASM International website, contact Leslie H. Chom, Electronic Marketing Manager, ASM International, Materials Park, OH 44073-0002; tel: 216/ 338-5151, ext. 510; fax: 216/ 338-4634; e-mail: lhchom@po.asm-intl.org.

New "Search Engines" for Materials Property Data

A quick way to find specific data on materials properties is with either a MAPP or a ROVER. Both are Windows-based interfaces that offer fast, easy access to the dozens of Mat.DB. metals and materials databases offered by ASM International.

ASM's software MAPP is a Windows- or Macintosh-based interface that enables the user to run any Mat.DB, database (available separately). Plastic Design Library's Rover combine book-like benefits with limitless search capabilities. Because the Rover search engine is included with each DataBook

purchase, no separate software is required. MAPP software is available on CD-ROM (Order #7453) or diskette (Order #7473) for $495.00; Mat.DB databases are available separately. Each self-contained Rover DataBook is $395.00 (ASM member, $325.00).

For more information about MAPP and Rover DataBooks, contact Sandy Dunigan, ASM Center for Materials Data Materials Park, OH 44073-0002; tel: 800/336-5152, ext. 701; fax: 216/338-4634; e-mail: memserv@po.asm-intl.org.

Cambridge Scientific

Cambridge Scientific Abstracts (CSA), the Washington, D.C.-based database producer, has acquired Materials Information, the world's leading computerized resource on metals and materials abstracts. Materials Information had been owned jointly by ASM International, based in Materials Park, OH, and The Institute of Materials (IOM), based in London. The agreement was signed in Bethesda by Robert N. Snyder, CSA Chairman and owner; Edward L. Langer, ASM Managing Director; and Dr. Ashley Catterall, IOM Secretary and Chief Executive.

Describing the purchase as "extremely significant for Cambridge Scientific," CSA President James P. McGinty said, "The acquisition of a well-established and respected database like Materials Information's METADEX will add a new scientific discipline to our already extensive portfolio." McGinty then announced the introduction of 10 Materials Information databases on CSA's Internet Database Service. Current subscribers to most Materials Information print journals will be offered complimentary Internet access to a five-year electronic backfire, updated monthly, on the World Wide Web.

Speaking for ASM and IOM, Langer said, "Since the late 1950s, when it introduced the first searchable metals database, Materials Information has developed many valuable innovations and services that have benefited materials engineers. However, we believe that selling Materials Information creates an enviable win-win situation for all concerned. Materials Information will be in capable hands that will ensure its future success, while continuing to bring maximum benefit to the worldwide materials community. At the same time, ASM and IOM will be able to focus more closely on those core activities demanded by our members and customers."

Ted Caris, CSA Publisher, said that existing Materials Information customers will experience "a completely seamless transition to Cambridge Scientific ownership." CSA will continue to provide services to ASM and IOM members at a discount, and the two societies will continue to be closely associated with Materials Information, helping in the collection and distribution of information and the marketing of Materials Information services to their members.

Materials Information is dedicated to collecting and disseminating the world's published knowledge on metals and engineered materials. More than 60,000 documents a year, ranging from journal articles and conference papers through reports and patents, are processed every year for incorporation into an extensive range of online databases, Internet services, CD-ROM products, and printed abstracts journals and other publications. Premier products include METADEX and its printed equivalent, Metals Abstracts, Aluminum Industry Abstracts, Composites Industry Abstracts, Advanced Polymers Abstracts, Engineered Materials Abstracts and Materials Business File. Its focus involves updating and maintaining bibliographic abstract databases in the fields of metallurgy and materials science.

The main office for Materials Information will move to the Bethesda headquarters of Cambridge Scientific Abstracts. An editorial office will remain in Ohio. Cambridge Scientific Abstracts publishes 36 databases and journals, all searchable through its Internet Database Service on the World Wide Web. Its publications cover major areas of scientific research, including environmental science and pollution management, biological sciences, aquatic sciences and fisheries, biotechnology, engineering, and computer science.

For further information, please contact Mark Furneaux, Materials Information, ASM International, Materials Park, OH 44073, tel: 216/338-5155; or Michael Miyazaki, Cambridge Scientific Abstracts, 7200 Wisconsin Ave., Bethesda, MD 20814; tel: 301/961-6761.

ASM Handbooks on CD-ROM

The first set of *ASM Handbooks on CD-ROM*, entitled *ASM Metals Properties and Performance Collection*, is being developed. It comprises Vol 1: *Properties and Selection: Irons, Steels and High-Performance Alloys* (1990), Vol 2: *Properties and Selection: Nonferrous Alloys and Special-Purpose Materials* (1990), Vol 13: *Corrosion* (1987), and Vol 18: *Friction, Lubrication, and Wear Technology* (1992).

Containing more than 4000 pages of information, this CD will allow the user to quickly search the material using powerful built-in retrieval capabilities that allows information to be found more quickly than with any print index. They'll also find numerous cross-referenced "links" within and between articles. With data on composition, properties, corrosion, and wear resistance, this Performance Collection is a single-source guide for the essential information needed to make the best materials selection. Text, tables, and figures can be printed out as needed.

Pricing and relase dates will be announced soon.

Contact ASM Member Services Center, Materials Park, OH 44073-0002; tel: 216/338-5151, ext. 900; fax: 216/338-4634.

Failure Analysis Material on CD-ROM

For the first time, vital information from ASM publications on failure analysis has been collected on one easy-to-operate CD. Users will be able to quickly search, view, and print from almost 5000 pages of case histories and reference books. They will be able to search all or a portion of the books with keywords grouped by industry, failure mode, material, or component. Users will be able to do a full-text search of all table titles, article titles, figure captions, or any selected article.

Additionally, there is hypertext linking for fast navigation, and convenient cut-and-paste compatibility to other Windows applications. With the ability to print out selected articles or all keywords, this CD is ideal for finding reference information when analyzing actual failures or conducting bibliographic searches on failure analysis.

Information comes from ASM books: *Metals Handbook*, Volume 11, 9th Edi-

tion; *Understanding How Components Fail: MEI Course On Failure Analysis*; *Materials Science and Engineering*; *Engineered Materials Handbooks,* Volumes 1, 2, and 4; *Analyzing Failures—The Problems and Solutions*; *Failure Analysis—Techniques and Applications*; *Fracture and Failure Analysis, Mechanisms and Applications*; *Failure Analysis—Case Histories and Methodology*; *Case Histories in Failure Analysis*; *Failure Analysis—The British Technical Reports*; *Handbook of Case Histories,* Volumes 1 and 2; and other selected publications.

In an entirely new approach, potential buyers can visit ASM's World Wide Web site at http://www.asm-intl.org for a free demonstration of this product. *ASM Failure Analysis on CD-ROM* will be available for $350.00 (ASM members $280.00). To order, contact ASM Member Services Center, Materials Park, OH 44073-0002; tel: 216/338-5151, ext. 900; fax: 216/338-4634. Refer to order #6555NR.

Alloy Digest on CD-ROM

The Complete Set of Alloy Digest on CD-ROM, covering 1952 to 1995, will be available from ASM International. It puts over 7800 pages (3900 data sheets) requiring 13 substantially sized binders onto one, convenient disk. Ideal for design engineers, metallurgists, government laboratories, and research libraries, this CD provides quick reference to the properties and suitability of any alloy under consideration. An extensive cross-referencing capability will be indispensable to anyone researching an alloy who knows only the trade name or other designation.

Users will be able to search by alloy name or by any one of the 34 material groups. Each sheet of *The Complete Set of Alloy Digest on CD-ROM* provides data on: chemical composition or characterization, physical and mechanical properties, heat treatment, machinability, workability, joinability, corrosion resistance, cleaning and pickling, specification equivalents, general characteristics, forms availability, application, and manufacturer.

"In an entirely new approach," states Bill Scott, Technical Director at ASM, "we're planning in the near future to offer a free demonstration of the ease and convenience of this CD on our World Wide Web site at http://www.asm-int.org." *The Complete Set of Alloy Digest on CD-ROM* will be available for $1800.00 (ASM members $1730.00). Current subscribers are entitled to a special price of $1200 (ASM members $1130.00). To order, contact ASM Member Services Center, Materials Park, OH 44073-0002; tel: 216/338-5151, ext. 900; fax: 216/338-4634. Refer to order #7506/7507NR.

Electronic Reference Tools Catalog

"Information That Goes to Work," the electronic information tools catalog containing the world's most comprehensive references and databases on metals and engineering materials, is available at no cost from ASM International.

Electronic information tools described in the new catalog include:

- *Alloy Finder CD-ROM,* which searches for metallic alloys by alloy trade name or designation, chemical composition, international designation, specification
- *Heat Treating Library on CD-ROM,* Ferrous Edition, which provides fast access to the largest body of heat treating information ever compiled
- MAPP, easy-to-use Windows- or Mac-based access to ASM's Mat.DB materials property databases
- *ASM Handbook on CD-ROM,* an all-in-one searching tool for the print version of the *ASM Handbook* series
- *ASM Failure Analysis CD-ROM,* for fast access to a library of case histories and related information on materials failure
- *Alloy Digest* (available for the first time in electronic form), containing more than 3500 data sheets on worldwide metals and alloys compiled from 1952 to 1995
- *Binary Alloy Phase Diagrams CD-ROM,* providing unmatched ease of use in finding and using binary phase diagram information and related crystal data
- Rover "Electronic DataBooks," for fast access to complete materials properties data as well as databases on corrosion and chemical resistance of metals and engineering materials

Free demonstrations of many ASM electronic information tools are available through the ASM MetalWorks Store at the ASM website, http://www.asm-intl.org. To receive a free copy of the new catalog, contact the ASM Member Services Center, Materials Park, OH 44073-0002; tel: 216/338-5151, ext. 900; fax: 216/338-4634; e-mail: mem-serv@po.asm-intl.org.

JPCL Archives—The Ten-Year Collection of JPCL on CD

JPCL Archives contains close to 1500 articles with information on how to select coatings for chemical plants, refineries, water tanks, bridges, power plants, ships, etc.; dealing with lead-based paint; working safely in blasting/painting operations; and writing effective specifications and bid packages. Also included are popular monthly columns like Problem Solving Forum and Regulation News.

To order, tel: 800/837-8303 or fax: 412/431-5428 or mail: 2100 Wharton St. Suite 310, Pittsburgh, PA 15203.

Struers on the Net

Struers brings the world of metallography to the Internet on http://www.struers.com.

Read the latest articles on Metallography from *Structure Magazine.* Peruse the Metalog Guide and learn new techniques on the preparation of metallographic samples. View the newest equipment and consumables used in the specimen preparation!

Visit NASA Tech Briefs

Visit NASA Tech Briefs on-line at http://ww.keds.com/ntb. Search 20+ years of tech briefs for new product ideas and engineering solutions.

Improvements in a Laser-Speckle Surface Strain Gage

Advances in a laser-speckle surface-strain gage have resulted in a compact, easy-to-use measurement package that exhibits improvement in performance over previous versions. The laser-speckle surface-strain gage is needed for noncontact measurements of strain in hot specimens of ceramic and other refractory materials. The operation of the laser-speckle surface-strain gage is based on Ichirou Yamaguchi's theory of deducing strains from shifts in speckle patterns of two laser beams reflected from a specimen: The principle of operation was described previously in two articles in *NASA Tech Briefs*, Vol 17 (No. 4), April 1993: "Laser System Measures Two-Dimensional Strain" (LEW-15046), page 22; and "Two-Dimensional Laser-Speckle Surface-Strain Gage" (LEW-15337), page 25.

A brief review of the principle of operation will help to explain the advantages of the current version of the laser-speckle surface-strain gage. Laser-speckle patterns, generated by the spatially coherent illumination of a rough specimen surface, shift when the surface is strained or when the specimen undergoes rigid-body motion. The speckle patterns are recorded on a two-dimensional array of charge-coupled devices (CCDs) before and after shifting, and cross-correlations of a single video line are calculated to determine the amount of shift between them. Errors contributed by rigid-body motions are canceled by taking differences between shifts of speckle patterns generated by two laser beams incident on the specimen from equal but opposite angles; only the strain components of the shifts remain after the subtraction.

The current version of the laser-speckle surface strain gage includes an improved, compact optical subsystem in which the illumination to form the speckle patterns is provided by two small, visible-wavelength laser diodes. The optical design enables the simultaneous recording of the two speckle patterns on a single two-dimensional CCD array. This greatly decreases the sensitivity of the measurement to rigid-body motion and makes it possible to determine surface strains accurately from measurements of speckle patterns that move faster and over longer distances because of faster dynamic loading of the specimen.

The current version also includes a high-performance digital image-data processor plugged into a bus on a desktop computer. The computer synchronizes the acquisition of image and load data, and the processor computes the strains from the speckle-image data, at a repetition rate of about 5 Hz. The overall system is fully automated under control of the computer and can be operated remotely.

This work was done by Christian T. Lant of Sverdrop Technology, Inc., for Lewis Research Center. For further information contact Ann Heywood; tel: 216/433-3484; e-mail: ann.o.heywood@lerc.nasa.gov. (Extracted from *NASA TechBriefs*, Vol 20 (No. 4), 1996, p 54-55. Refer to LEW-15914.)

Designing Ni- and Co-Base Superalloys to Resist Oxidation

An equation that characterizes the abilities of superalloys to resist oxidation at high temperatures may prove useful for designing new alloy compositions to resist oxidation. The equation rates the tendency to become oxidized in terms of a single attack parameter, K_a, as a function of composition and temperature: a decrease in K_a signifies an increase in resistance to oxidation.

The use of K_a as a measure of thermo-oxidative instability and the equation for K_a as a function of temperature and composition were derived in an experimental and statistical study of the cyclic oxidation of 36 Ni- and Co-based superalloys. A typical alloy specimen was tested in cycles, during each of which the specimen was exposed for 1 h in a furnace in static air at a temperature of 1000, 1100, or 1150 °C, then automatically lifted out of the furnace for a minimum of 20 min. This cycle was repeated 100, 200, or 500 times for 1150, 1100, or 1000 °C, respectively. At selected time intervals between cycles, each specimen was weighed to determine its specific weight loss ($\Delta W/A$) as a function of cycle time (t).

By use of multiple linear regression, the $\Delta W/A$ versus t data for each specimen were fitted to $\Delta W/A = k_1^{1/2} t^{1/2} \pm k_2^{t} \pm \sigma$, where $k_1^{1/2}$ and k_2 are analogous to oxide-scale growth and oxide scale-spalling, constants, and σ is a standard error. The data for each specimen were reduced to a single attack parameter via $K_a = k_1^{1/2} + 10k_2$. The attack parameter K_a can be used to rank the ability of an alloy to resist oxidation at a given temperature: the higher the value of K_a, the poorer the resistance. Analysis of a large body of data showed that resistance to oxidation ranges from excellent at $K_a \leq 0.20$ through poor at $1.0 \leq K_a \leq 5.0$ to catastrophically poor at $K_a > 5.0$.

The equation of $\log_{10} K_a$ as a function of temperature and composition was obtained by multiple regression analysis on 315 experimental values of these parameters. The equation consists of 14 terms, which include terms up to second order in the proportions of constituent elements, plus a term proportional to the reciprocal of absolute temperature. The validity of the estimating equation was tested by predicting K_a values for a related alloy run under similar conditions.

Of the coefficients of the compositional terms in the equation, only three were found to be negative (see table), signifying that increases in the proportions of the particular constituents (Cr, Al, and Ta) would reduce K_a, thus increasing resistance to oxidation; in the cases of some other constituents, decreases in their proportions could result in decreases in K_a. More specifically, the coefficients show that (a) increases in proportions of Cr and Al are beneficial, (b) an increase in the proportion of Ta is beneficial when Al is present, (c) an increase in the proportion of Nb is dele-

Table 1

Significant Terms	Coefficient ($\log_{10} K_a$)
Al · Ta	–0.3008490
$1/T_k$	–28,733.83015
Al^2	–0.05162169
Al · V	+0.16395511
Cr	–0.71873828
Nb · Ta	+0.05346153
Cr · ($1/T_k$)	+924.75130
Ti · Ta	+0.01932161
Cr · W	+0.003726623
Al · Mo	+0.01273215
Ti · Nb	+0.08140372
Nb · Hf	+0.24155034
Ti	+0.08344541
Re	+0.21293029
a_0 (intercept)	22.75638644
R^2 + 84.43%, S.E.E. = 0.352155	

terious when Ta, Ti, and Hf are present, and (d) the proportions of Mo and W should be minimized because they increase K_a when Al and Cr, respectively, are present.

One could attempt to use the equation and its coefficients to choose an optimal composition of a new alloy, subject to constraints imposed on compositions by other criteria based on chemical, microstructural, and/or mechanical considerations. One such proposed composition for a strong, oxidation-resistant superalloy would be (in approximate wt%) Ni-10Co-6Al-5Cr-8.6Ta-0.9Ti-1Hf-0.15C -0.01B-0.05Zr. This work was done by Charles A. Barrett of Lewis Research Center.

These coefficients of significant terms in composition and absolute temperature (T) in the equation for log (K_a) were derived by multiple regression. See Table 1.

For further information contact Ann Heywood; tel: 216/433-3484; e-mail: ann.o.heywood@lerc.nasa.gov. (Extracted from *NASA TechBriefs*, Vol 20 (No. 5), 1996, p 63-64. Refer to LEW-15910.)

A Letter to the Editor

In response to your editorial in March issue of the *JTST*, I would like again to bring to your attention our recent activities in the area of the novel peel adhesion test (PAT) for thermal sprayed coatings. We have applied PAT to many different combinations of coating/substrate systems and, as you know, some of these are being now published in *JTST*. In the last half year, we were testing PAT in extreme conditions, e.g., for Al/SiC cermet applied to Al surfaces, where all results indicate formation of a metallurgical bond due to low melting point of Al. We were recently able to observe a significant effect of post-deposition treatment (sol-gel sealing) of TBCs on the peel adhesion strength. These results will be presented at the NTSC in October. We hope to generate soon some PAT data from D-gun coatings, which are generally not treatable by the tensile adhesion test.

We are exploring application of PAT for other coatings, e.g., Zn on hot galvanized steel. We have also developed a "solderless" method for PAT, based on highly conductive Cu-epoxy composites. We are extensively testing and modeling effects of plastic deformation of substrate foils on test results. The final aim is to eliminate the need of gluing the foils, to make the PAT method more attractive to shop-floor testing.

We have found PAT a simple, very attractive, high resolution alternative to the classical methods of adhesion testing. We now seem to have in hand a method, an expertise, and tools to perform a systematic, more fundamental study of adhesion of these coatings, as a function of a multitude of processing parameters, substrate preparation parameters, and powder characteristics. Having these to offer, we would like to join collaborative research activities of the thermal spray community related to adhesion of coatings.

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The Second Global Symposium on HVOF Coatings

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The Second Global Symposium on HVOF Coatings was held 3 May 1996, in Tulsa, OK. The symposium was sponsored by Southwest Aeroservice and the Mechanical Engineering Department of The University of Tulsa. The meeting concerned the replacement of chrome plating by HVOF tungsten carbide thermal spray coatings on aircraft components, in particular, on landing gear. This meeting continued the discussion that began at the First Global Symposium held in 1995 in Toronto, Canada. Forty representatives from the aircraft industry, the military, aircraft equipment manufacturers, thermal spray equipment and materials suppliers, aircraft service companies, and research institutions attended the Second Global Symposium.

Eight technical presentations were delivered at the symposium. These included two presentations by representatives of end users (Lufthansa and Cummins Engine) concerning their experience with tungsten carbide coatings. Three presentations concerned coating and powder properties. The final two presentations concerned fatigue testing of tungsten carbide coatings.

A roundtable discussion of directions for research followed the technical presentations. This discussion focused on standardizing fatigue testing practices. Most participants agreed on the need for standardized testing, although no specific test procedures were established,

The results of a questionnaire that was completed by the attendees at the First Global Symposium were also distributed at the meeting. These results indicate a high interest in HVOF coatings as candidates for chrome replacement. Those who responded indicated that 0 to 20% of chrome plating applications could be replaced immediately and a total of 90% could be replaced in 2 to 4 years. Areas in which a "High" to "Very High" interest in further research were indicated are: (1) high cycle fatigue, (2) effects of grinding, shot peening and grit blasting on fatigue properties, (3) effects of coating thickness on fatigue properties, (4) wear properties, (5) adhesion, bond strength properties, and (6) compatibility with existing repair practices.

The Second Global Symposium on HVOF Coatings continued to provide the occasion for the open discussion of chrome replacement issues that was begun at the First Global Symposium. A Third Symposium is being planned. For information, please contact Bruce Bodger (bbodger@ttown.com), of Southwest Aeroservice, 1501 E. 4th Place, Tulsa, OK 74120 or Roy McGrann (mcgrannrt@centum.utulsa.edu), of The University of Tulsa, 600 S. College Ave., Tulsa, OK 74104.

Society News

Joining of ASM-TSS and DVS

An annual international conference and exhibition on thermal spray technology and applications is planned as a result of an agreement made by the ASM Thermal Spray Society (ASM-TSS) and the German Welding Society (Deutscher Verband fur Schweisstechnik, DVS). ASM-TSS and DVS have agreed to jointly organize, market, and develop technical and commercial programs for the annual conference and industrial exhibition. The first jointly sponsored event will be held in Nov 1997 in Indianapolis, IN, and will rotate between locations in the United States, Europe, and Asia thereafter.

In a joint statement, DVS Managing Director Prof. Dr.-Ing. Detlef von Hofe and ASM-TSS Executive Director Robert C. Uhl said the agreement would link the world's two strongest thermal spray technical organizations, enabling a globalization of both the conference and its content. "Combining our efforts will increase the depth of technical and organizational support that can be brought to the international thermal spray community and will allow for better coordination of technical programs, technology, and commercial topics," said Prof. Dr.-Ing. von Hofe. "This new venture will also enable us to increase conference quality and service, as both societies are already well known for their work with the National Thermal Spray Conference (ASM-TSS) and TS (DVS)."

For more information, contact Prof. Dr.-Ing. Detlef von Hofe, Deutscher Verband fur Schweisstechnik, Aachener Str. 172, 40223 Dusseldorf, Germany; tel: (49/211) 1591-103; fax: (49/211) 1591-200. Or, contact Robert C. Uhl at ASM-TSS, ASM International, Materials Park, OH 44073-0002; tel: 216/338-5151; fax: 216/338-4634.

'Future of Heat Treating' Vision Taking Shape

What technological advances will heat treaters work with by the year 2020? How will these advances enable heat treaters to meet customer demands while staying competitive and profitable on the bottom line? What will regulators ask of heat treaters? Will government be a greater help or a hindrance? These were among the questions discussed by a group of 20 leaders representing the entire heat treating community, including commercial and captive heat treaters, manufacturers, and suppliers. These leaders gathered at the invitation of the ASM Heat Treating Society, the Metal Treating Institute and the U.S. Department of Energy's Office of Industrial Technologies on 27-28 Feb in Chicago.

"The DOE has identified seven U.S. industries that use 80% of manufacturing energy and create 90% of manufacturing wastes," explained Tex Sorrell of the DOE's Office of Industrial Technologies (OIT). "These seven industries are forest products, chemicals, petroleum refining, metal casting, steel, aluminum, and glass. Wherever metals are concerned, you'll find heat treating. That's why we're interested in understanding how the DOE can help heat treaters become more efficient and better at what they do." "The objective of the DOE's 'Industries of the Future' process is not to provide funding for research," Sorrell said. "Instead, the process is meant to understand the future needs of industry and match them with the vast research capabilities of U.S. national research laboratories."

"Our February meetings were the first step toward shaping the future," said Jerry Hoeft, ASM-HTS President. "We met to harness and organize our ideas through brainstorming and discussion, and—as you can imagine—there was some very spirited conversation around the table. But by the end of the workshop, we were able to arrive at a consensus with the comfort and confidence levels we were looking for."

A draft vision statement based on the participants' efforts is being developed by Wally Bamford, Leo Thompson, and Ron Wallis. Once approved by the participants, and with the input and support of a larger circle of heat treaters, the vision statement will be announced in July. A "technology roadmap" describing specific strategies to achieve the vision will then be developed and implemented by Oct 1996.

For more information about the Heat Treating Vision Process, or the ASM Heat Treating Society, contact ASM-HTS Communications, Materials Park, OH 44073-0002; tel: 800/ASM-4HTS, ext. 622; fax: 216/338-4634; e-mail: rgiovane@po.asm-intl.org or http://www.asm-intl.org.

Company News

Materials Resources International

Materials Resources International (MRi) has assembled an extensive portfolio of products utilizing the latest in materials technology—all proven by extensive R&D—and now offers solutions and products in: braze joining, surfacing, and difficult-to-form materials (e.g., refractory metals, ceramics, and composites).

MRi is dedicated to bringing the latest materials technology solutions to industry by uniquely linking a growing list of some of the world's best materials and processing research centers and industrial technology companies in its worldwide network which now includes: Drexel University; Technical University of Aachen, Germany; Euromat; E.O. Paton Electric Welding Institute; Lepel Corporation; Exotherm Corporation and Degussa, AG. MRi has links with most U.S. National Laboratories and Agencies, European R&D organizations and many other international R&D organizations to add depth to MRi's capability to solve materials technology problems.

MRi was founded in 1995 by four leading material technologists and entrepreneurs, Dr. Ronald W. Smith, President of MRi and Professor at Drexel University, Professor Dr. tech Erich Lugscheider of RWTH Aachen and founder of Euromat, Mr. Merle Thorpe of Thorpe Thermal

Technologies and founder of TAFA Inc., and John Iademarco, former President of Teleflex Aerospace.

MRi's aim is to put materials technology to work for you, solving many of your most difficult joining, surfacing, and materials forming problems. MRi's product family includes:

- Fluxless, air brazing materials for aluminum and for joining ceramics to metals
- Braze materials and preforms
- WideGap brazing materials
- InductoBraze brazing materials
- Dissimilar metal brazing materials and preforms
- Thin, hard and general corrosion resistant exothermically formed coatings, ExoCoat
- Thick wear resistant claddings —BrazeCoat
- HiWear components and inserts
- Special thermal spray powders
- Thermal spray formed components and materials
- Roll formed ceramic materials for use in thermal processing and/or electronics

Contact: MRi, 1162 Horseshoe Drive, Blue Bell, PA 19422; tel: 215/393-5703; fax: 215/393-5704; e-mail: solution@mri-bluebell.com.

Stellite Coatings Offers PTA Training Class

Stellite Coatings, based in Goshen, IN, recently completed their second plasma transferred arc (PTA) training class. The two-day PTA training class is a mixture of classroom and hands-on training. Participants are educated on proper preheat and welding procedures as well as post welding treatment for Stellite (cobalt-base), Deloro (nickel-base) and Tristelle (iron-base) alloys. The class includes exposure to the latest technology in PTA equipment and procedures. For more information concerning the next PTA training class, contact Nancy Sporn at 800/235-9353.

People in the News

Sermatech Names Marketing VP for Turbine Services

Dr. Srinivasan Shankar has recently joined Sermatech International as Vice President of Turbine Services Marketing. In his new position, Dr. Shankar will be responsible for the marketing of Sermatech's protective coatings and repairs used in the hot section of flight and industrial gas turbines.

Prior to joining Sermatech, Dr. Shankar was Business Center Manager at Turbine Components Corporation (TCC) of Branford, CT, where he was responsible for the company's coating operations and land-based turbine engine component repairs. He also was previously involved in casting and powder coating processes, and the development of diffusion and overlay coatings with the Howmet Corporation Technical Center.

Dr. Shankar holds several patents and has published technical papers relating to high-temperature coatings and repairs. He holds a Bachelor of Technology degree in metallurgy from the Indian Institute of Technology, Madras, and earned a doctorate in materials science from the State University of New York at Stony Brook. He will be located at the Serrnatech facility in Manchester, CT.

Sermatech International, headquartered in Limerick, PA, is among the world's top suppliers of protective coatings and component repairs for flight turbines, and a leading provider of such services for industrial turbomachinery. The company operates service centers throughout the industrialized world. Sermatech is a wholly owned subsidiary of Teleflex Incorporated.

Bergquist Joins Howmet as VP, Sales and Marketing

Howmet Corporation has appointed Allan H. Bergquist to be Vice President, Sales and Marketing. Bergquist will report to David L. Squier, CEO and President.

Prior to joining Howmet, Bergquist was Director, Marketing of AlliedSignal's Aerospace Environmental Control Systems Business Unit. He has served AlliedSignal in a number of positions, including: Sales Manager, Airline and General Aviation Engines; Corporate Director, Engine and Aircraft Systems; General Sales Manager, AlliedSignal Garrett and Vice President of Marketing and Sales, Fluid Systems Division. Before joining AlliedSignal, Bergquist resided in Seattle, WA, where he managed the Boeing account for Pratt & Whitney Aircraft Engines. He also served in positions with Pratt & Whitney in East Hartford, CT, Cleveland, OH, and West Palm Beach, FL. Bergquist has a B.S., Mechanical Engineering from Norwich University and an M.B.A. from Western New England College.

"Growth depends on exceeding customer needs with the best products and services," says Bergquist. "Howmet already has strong customer relationships and a solid position in its markets. My role is to help strengthen those relationships and build the business by sharpening our focus on improving teamwork both within the organization and with customers.

Howmet is a world leader in the manufacture of precision investment castings of superalloy, titanium, and aluminum alloys, primarily for jet aircraft and industrial gas turbine engines. Howmet and its affiliates have annual sales of more than $900 million and operate 30 manufacturing facilities in the United States, Canada, France, the United Kingdom, and Japan.

Wall Colmonoy Appoints New Export Sales Administrator

D. Jaramillo

Demetrio Jaramillo recently joined Wall Colmonoy Corporation (Madison Heights, MI) as Export Sales Administrator. He is responsible for coordinating all ex-

port operations and pursuing new markets in Latin America, Asia, and the Far East. He also provides customer service for Wall Colmonoy's distributors throughout the world.

Jaramillo, fluent in both Spanish and English, is a native of Monterrey, Mexico, where he earned degrees in law and international business. He also gained more than three years import/export experience while working for a manufacturing company in Mexico.

Wall Colmonoy Corporation manufactures hard-surfacing alloys for the plastics, glass, and petrochemical industries; and high-temperature brazing alloys for the aerospace, automotive, and power-generation industries. Wall Colmonoy's world headquarters is located in Madison Heights, MI, with subsidiaries in Canada, Great Britain, and France.