

MILO V. KRAL

University of Canterbury
Department of Mechanical Engineering
PO Box 4800
Christchurch
NEW ZEALAND 8081
<http://www.mech.canterbury.ac.nz/people/kral.shtml>
(03) 364-2987 ext. 7392
(03) 364-2078 (fax)
021-796-795 (cell)

EDUCATION (Vanderbilt University, Nashville TN USA.)

Feb. 1996 Ph.D., Materials Science and Engineering, minor in Mechanical Engineering,
May 1992 M.S., Materials Science and Engineering.
May 1984 B.E., Mechanical Engineering.

PROFESSIONAL EXPERIENCE

Department of Mechanical Engineering, University of Canterbury, Christchurch, New Zealand.

Associate Professor, Jan 2006 – present.
Senior Lecturer above the bar, Jan 2005 – Dec 2005.
Senior Lecturer, Jan 2000 – Dec 2004.
Lecturer, May 1998 – Dec 1999.

Teaching

ENME227 Introduction to Engineering Materials
ENME457 Fracture and Failure Analysis
ENME603 Electron Microscopy and Diffraction Methods in Materials Science

Other achievements

Head of Department, July 2007 – present.
Deputy Head of Department August 2005 – July 2007.
Chair Research Committee, August 2005 – present.
Originator and Director of ENME438 Final Year Mechanical Engineering Projects Program.

Metallurgical and Materials Consultants Ltd., Christchurch NZ

1998 – present: Private consultant to a variety of industrial clients on design, materials selection, materials testing, manufacturing problems and failure analysis.

U.S. Naval Research Laboratory, Washington, DC.

Mar. 1996 - April 1998 ASEE Postdoctoral Fellow, Physical Metallurgy Branch,

Materials Science Department, Vanderbilt University, Nashville, TN.

Sept 1990- Feb 1996 Teaching and Research Assistant, graduate student.

Electronic Data Systems at Rochester Products Division of General Motors.

Jan - Aug 1990 Team Leader, Engineering systems group.
Jan - Dec 1989 Project Manager seconded to AC Spark Plug Division.
Dec. 1984 -Nov. 1988 Systems Engineer and applications programmer.

Other part-time or temporary positions

Visiting scientist, Materials Engineering Dept, Monash Univ., Australia. Jan - July 2004.

Visiting scientist, Physical Metallurgy Branch, U.S. NRL Sept - Oct 2003
 PNNL Fellow, Pacific Northwest National Laboratory, Richland WA Aug 2003
 Metallurgical Engineer, James Wert and Associates, Nashville, TN Apr 1991- Feb 1996

CURRENTLY FUNDED RESEARCH PROJECTS

Understanding fundamental mechanisms of creep in magnesium alloys, Ph.D.
 Grain boundary engineering of alloy 800HT to achieve maximum creep life, Ph.D.
 Understanding effects of micro-alloying of HP50 reformer tubes, Ph.D.
 Minimizing erosion of cast iron by liquid aluminum to achieve ultra-high purity smelting, Ph.D.

OTHER RESEARCH INTERESTS

Magnesium and aluminum alloy development
 Intermetallic phases in light alloys
 Strengthening via solid state precipitation in titanium-X-rare earth alloys
 Electron Diffraction methods (EBSD, CBED)
 Three-dimensional analysis of microstructures
 Cementite in austenitic steels

RESEARCH FUNDING AWARDS (since 2002 in \$NZ)

2003	Industry Support (various sources) for Final Year Projects	\$91000
	Technology New Zealand Pivotal Engines (TIF)	\$25000
	Technology New Zealand Ion Automotive (TIF)	\$90000
	Methanex (NZ) Limited and Schmidt & Clemens (Spain)	\$120000
	University of Canterbury Study Leave Grant	\$12000
	US Naval Research Lab Visiting Scientist Grant	\$20000
2004	University of Canterbury Engineering CAPEX allocation	\$90000
	Monash University Visiting Scientist Grant	\$6000
2005	Technology New Zealand Whispertech (TIF)	\$25000
	Whispertech support for TIF	\$19000
	Macdiarmid Institute	\$5000
	AINSE Award (AU\$7848)	\$8720
	TEC Enterprise Scholarship	\$3000
	Methanex (NZ) Ltd. co-funding to TEC scholarship	\$3000
	TechNet	\$5000
	Consultancy overheads and fees	\$44318
2006	Field emission SEM funding (internal)	\$570000
	Canesis contribution to electron microscope 2006 - 2008	\$51000
	Macdiarmid contribution to electron microscope 2006 - 2008	\$20000
	Methanex (NZ) Ltd. (US\$10000 per year 2006-2008)	\$46000
	Methanex Methanol Diesel Project	\$7000
	TEC Enterprise Scholarship	\$37500
	Consultancy overheads and fees (non-salary)	\$104176
	Industry Support (various sources) for Final Year Projects	\$100000
	TechNet (3)	\$12000
2007	Tubacex (Spain) (euros 10000 per year 2007-2009)	\$51600
	Schmidt & Clemens (Spain) (euros 10000 per year 2007-2009)	\$51600
	Industry Support (various sources) for Final Year Projects (approx.)	\$125000
	Consultancy overheads and fees	\$82366
2008	PhD TIF Technology New Zealand with Quest Reliability	\$93000
	Quest Reliability additional funding to TIF(2008-2010)	\$36650
	Rio Tinto Comalco (NZAS) funding (2008-2010)	\$40000
	Shell Global Solutions (Netherlands) (euros 15000/year 2008-2010)	\$90000

PROFESSIONAL SOCIETY MEMBERSHIPS

Alpha Sigma Mu, Materials Honorary Society

Sigma Xi, Scientific Research Society

The Minerals, Metals and Materials Society (TMS), Phase Transformations Committee

SYMPOSIA ORGANIZED

1. Symposium on "3D Analysis of Microstructures, Characterization and Representation of Material Microstructures in 3-D" TMS Fall Meeting 2002 Columbus Ohio.
2. Symposium on "Applications of EBSD to Phase Transformations", Materials Science and Technology 2004 New Orleans Louisiana.
3. Symposium on "Advances in Microstructural Characterization Techniques", Microscopy and Microanalysis 2005 Honolulu Hawaii.
4. Symposium on "Recent Industrial Applications of Solid State Phase Transformations", TMS Annual Meeting 2008, New Orleans LA

HONORS AND AWARDS

Engineer-in-Training Exam Passed, State of Tennessee, 1984.

Teaching Assistantship, Vanderbilt University 1990-1992.

Graduate Research Fellowship, Vanderbilt University 1992-1996.

American Society of Engineering Education Postdoctoral Fellowship 1996-1998.

Featured Research Article in the 1997 US Naval Research Laboratory Review.

Best paper/presentation at IMMA Materials 98, Wollongong NSW Australia.

Alan Berman Research Publications Award, US Naval Research Laboratory (1999).

Key reader and member of the Board of Review for *Metallurgical and Materials Transactions*, January 2000-present (since 2004, 4 manuscripts 2004, 6 in 2005, 6 in 2006 and 5 in 2007)

Reviewer for:

ICAMP-1 (2000)

ICAMP-3 (2004)

Metallurgical and Materials Transactions (1996-present)

Materials Science and Engineering A (2003, 2006 and 3 in 2007)

International Journal of Cast Metal Research (2004)

Waste Management (2004)

Ultramicroscopy (2005)

Microscopy Research & Techniques (2005)

Journal of Alloys and Compounds (2006, 2008)

Scripta Materialia (2006)

Journal of Materials Science (2006).

PUBLICATIONS (last update 14 April 2008)

ARTICLES/PAPERS IN REFEREED JOURNALS (Citations in bold taken from Web of Science Citation Index)

1. Kral, M.V. and Spanos, G. TEM Observations of Interfacial Structure and Crystallography of Grain Boundary Proeutectoid Cementite Precipitates, in review *Materials Science and Engineering A* (2008).
2. Spanos, G. and Kral, M.V. The Proeutectoid Cementite Transformation in Steels, in review *International Materials Reviews* (2008).
3. Sato, T. and Kral, M.V., EBSD Mapping Microstructural Evolution of Pure Magnesium During Creep, *Materials and Metallurgical Transactions A* Vol. 39 (3) 2008: 688-695.
4. Kral, M.V., Muddle, B.C. and Nie, J.-F., Crystallography of the BCC/HCP Transformation in a Mg-8Li Alloy, *Materials Science and Engineering A* Vol. 460-461 2007: 227 – 232.
5. De Graef, M., Kral, M.V. and Hillert, M., A Modern 3-D View Of An “Old” Pearlite Colony, *Journal of the Minerals, Metals and Materials Society (JOM)* Vol.12 2006: 25-28.
6. Kral, M.V. Nakashima, P.K.N. and Mitchell, D.R., An Electron Microscope Study of Al-Fe-Si Intermetallics in Eutectic Al-Si Alloys, *Metallurgical and Materials Transactions* 37A (6) 2006: 1987-1997.
7. Scott, S. A., Kral M. V. and Brown S. A., Bi on Graphite: Morphology and Growth of Star-Shaped Dendrites, *Phys. Rev. B* 73, 2006: 205424.
8. Wahab, A. A., Hutchinson, C.R. and Kral, M.V., A Three-Dimensional Characterization of Creep Void Formation in Hydrogen Reformer Tubes, *Scripta Materialia* Vol. 55 (1) 2006: 69 – 73. **Invited for Special Viewpoint Set. 1 citation.**
9. Wahab, A. A. and Kral, M.V., 3D Analysis of Creep Voids in Hydrogen Reformer Tubes, *Materials Science and Engineering A*, Vol. 412 (1-2) 2005: 222 - 229. **1 citation.**
10. Scott, S.A., Kral, M.V. and Brown, S.A., Growth of oriented Bi nanorods at highly ordered pyrolytic-graphite step-edges, *Physics Review B*, Vol. 72, 205423 2005: 1 - 8. **2 citations.**
11. Kral, M.V. and Spanos, G. Three Dimensional Analysis and Classification of Grain Boundary Nucleated Proeutectoid Ferrite Precipitates, *Metallurgical and Materials Transactions* Vol. 36A, no. 5 2005: 1199-1207. **4 citations.**
12. Spanos, G., Wilson, A.W. and Kral, M.V. New Insights into the Widmanstätten Proeutectoid Ferrite Transformation, *Metallurgical and Materials Transactions* Vol. 36A, no. 5 2005: 1209-1218. **4 citations.**
13. Kral, M.V., A Crystallographic Identification of Intermetallic Phases in Al-Si Alloys, *Materials Letters*, Vol. 59, no.18 2005: 2271-2276. **2 citations.**
14. Scott, S.A., Kral, M.V. and Brown, S.A., A Crystallographic Orientation Transition And Early Stage Growth Characteristics Of Thin Bismuth Films On HOPG, *Surface Science*, Vol. 587, no. 3 2005: 175-184. **7 citations.**
15. Song, G.S. and Kral, M.V., Characterization of Cast Mg-Li-Ca Alloys, *Materials Characterization*, Vol. 54/4-5 2004: 279-286. . **2 citations.**
16. Uchic M.D., Kral M.V., Spanos G. and Dimiduk, D.M. Symposium On Characterization And Representation Of Materials Microstructures In 3D – Foreword, *Metallurgical And Materials Transactions* Vol. 35A, no. 7 2004: 1925.
17. Kral, M.V., McIntyre, H.R. and Smillie, M.J. Identification of Intermetallic Phases in Eutectic Al-Si Casting Alloy using Electron Backscatter Diffraction Pattern Analysis, *Scripta Materialia*, Vol. 51/3 2004: 215-219. **15 citations.**
18. Song, G.S., Staiger, M.S. and Kral, M.V., Some new characteristics of the strengthening phase

in beta-phase magnesium lithium alloys containing aluminum and beryllium, *Materials Science and Engineering A*, Vol. 371/1-2, 2004: 371-376. **2 citations.**

19. Kral, M.V. and Spanos, G. Crystallography of Solid State Grain Boundary Cementite Dendrites, *Acta Mater.* Vol. 51 no2, 2003: 301-311. **6 citations.**
20. Hung, C-Y Spanos, G. Rosenberg, R.O. and Kral, M.V. Three-Dimensional Observations of Proeutectoid Cementite Precipitates at Short Isothermal Transformation Times, *Acta Mater.* Vol. 50 no15, 2002: 3781-3788. **10 citations.**
21. Kral, M.V., Transmission Electron Microscopy of Deep Etched Cementite. *Materials Characterization*, Vol. 45 no2 2000: 105-110. **3 citations.**
22. Kral, M.V., Mangan, M.A., Rosenberg, R.O. and Spanos, G. Three-Dimensional Analysis of Microstructures. *Materials Characterization*, Vol. 45 no1, 2000: 17-23. **34 citations.**
23. Kral, M.V. and Fonda, R.W. The Primary Growth Direction of Widmanstätten Cementite Laths. *Scripta Materialia*, Vol. 43 no2, 2000: 193-198. **2 citations.**
24. Kral, M.V. and Spanos, G. Three Dimensional Analysis of Proeutectoid Cementite Precipitates. *Acta Metallurgica*, v47 no2, 1999: 711 - 724. **48 citations.**
25. Mangan, M.A., Kral, M.V. and Spanos, G. Correlation between the Crystallography and Morphology of Proeutectoid Widmanstätten Cementite Precipitates. *Acta Materialia*, Vol. 47 no17, 1999: 4263-4274. **9 citations.**
26. Kral, M.V. and Mangan, M.A. The Morphology and Crystallography of Proeutectoid Widmanstätten Cementite Precipitates. *Materials Australia*, IMEA Press, v30 no5, 1998: 10-16.
27. Lane, J.E., Bogitsh, B.J., Ribeiro-Rodrigues, R., Kral, M.V., Jones, M.M. and Carter, C.E. Ultrastructural effects of the chelating agent 1,10-phenanthroline on *Trypanosoma cruzi* epimastigotes in vitro. *Parasitol. Res.*, v84 no5, 1998: 399-402. **1 citation.**
28. Kral, M.V., Hofmeister, W.H. and Wittig, J.E. Interphase Boundary Precipitation in a Ti-1.7 at. % Er Alloy. *Metallurgical Transactions*, v28A no12, 1997: 2485 - 2497.
29. Kral, M.V. and Spanos, G. Three Dimensional Morphology of Cementite Precipitates. *Scripta Materialia*, v36 no8, 1997: 875-882. **19 citations.**
30. Kral, M.V., Hofmeister, W.H. and Wittig, J.E. Morphology and Crystallography of Interphase Precipitates in Undercooled, Rapidly Solidified Titanium Rare Earth Alloys"; *Scripta Materialia and Metallurgica*, v36 no2, 1997: 157 - 163. **1 citation.**
31. Kral, M.V., Davidson J.L. and Wert, J.J. Erosion Resistance of Diamond Coatings. *Wear*, 166, 1993: 7 - 16. **13 citations.**

PAPERS PUBLISHED IN REFEREED CONFERENCE PROCEEDINGS

1. **(invited)** Wahab, A. A. and Kral, M.V., A Three Dimensional View of High Temperature Creep Damage Proceedings: 4th International Workshop on Materials Issues Governing the Performance of Advanced 21st Century Energy Systems 27th February – 1st March 2006 Wellington New Zealand. Under review *Materials at High Temperature*.
2. S. A. Scott, M. V. Kral and S. A. Brown, Growth of nanorods and mesoscale stars prior to an orientation transition in thin Bi films on graphite, *Appl. Surf. Sci.* 252, 5563-5567 (2006) (Proceedings of the Eight International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures and the Thirteenth International Congress on Thin Films - ACSIN8/ICTF13 19-23 June 2005 Stockholm, Sweden)
3. Miller, D. and Kral, M.V. Improving Wear Properties of Pivotal Engine Seals; Proceedings: World Tribology Conference III 12 – 16 September 2005, Washington DC ISBN: 0791842010 pages 957-958.

4. **(invited)** Abdul Wahab, A. and Kral, M.V. Three-Dimensional Analysis of Creep Voids; Proceedings: Microscopy and Microanalysis 2005, 31 July – 4 August Honolulu HI, 2005: 224-225.
5. Sato, T. Mordike, B.L., Nie, J-F. and Kral, M.V. An Electron Microscope Study Of Intermetallic Phases In AZ91 Alloy Variants; Proceedings: Magnesium Technology 2005, TMS Annual Meeting, San Francisco, CA; Edited by N.R. Neelameggham, H.I. Kaplan, and B.R. Powell; TMS (The Minerals, Metals & Materials Society), 2005: 435-440.
6. McIntyre, H.R., Looij, J. and Kral, M.V., Effects of Simultaneous Na and Sr Additions in a Eutectic Al-Si Casting Alloy, Proceedings of the Symposium on Solidification of Aluminum Alloys, Charlotte, NC USA : Mar 14 – 18 2004, Men Glenn Chu and Douglas A. Granger, editors: ISBN: 0-87339-569-7, 2004:111-120.
7. **(invited)** Spanos, G., Gupta, A., Lewis, A.C., Geltmacher, A. and Kral, M.V. Application of 3D Serial Sectioning and Analysis Techniques to Study Microstructural Evolution; 25th Risø International Symposium on Materials Science: Evolution of Deformation Microstructures in 3D September 6 – 10, 2004 at Risø National Laboratory, Denmark, 2004: 137-146.
8. Song, G.S., Staiger, M.S and Kral, M.V. Enhancement of the properties of Mg-Li alloys by small alloying additions, Proceedings: Magnesium Technology 2003, TMS Annual Meeting, San Diego, CA 2003, pp. 77 - 80.
9. **(invited)** Spanos, G., Hung, C-Y. and Kral, M.V., The Morphology, Crystallography, and Formation Mechanism of Grain Boundary Proeutectoid Cementite in High Carbon Steels, Materials Science Forum, Volume 426-4, Proceedings of the 4th International Conference on Processing and Manufacturing of Advanced Materials, "THERMEC2003", held from July 7-11, 2003 at the Universidad Carlos III de Madrid, Leganes, Spain, under the co-sponsorship of The Minerals, Metals and Materials Society (TMS), USA, edited by T. Chandra, Jose Maria Torralba and T. Sakai, ISBN: 0-87849-919-9, 2003:1599-1604.
10. **(invited)** Spanos, G. and Kral, M.V., The Proeutectoid Cementite Transformation, Proceedings of the Symposium on Austenite Formation and Decomposition at Materials Science and Technology 2003, Chicago. IL Nov 9 –12 2003, edited by E. Buddy Damm, ISBN: 0-87339-559-X, 2003:415-424.
11. **(invited)** Fonda, R.W, Reynolds, W.T. and Kral, M.V., The Interfacial Structure of Widmanstätten Cementite Laths, Proceedings of the Symposium on Austenite Formation and Decomposition at Materials Science and Technology 2003, Chicago. IL Nov 9 –12 2003, edited by E. Buddy Damm, ISBN: 0-87339-559-X, 2003:425-436.
12. Spanos, G., Kral, M.V. and Wilson, A. W. Some Recent Applications Of Electron and Optical Microscopy Techniques To Study Phase Transformations In Steels, Proceedings of Microscopy and Microanalysis 9 (Suppl 2) 2003, San Antonio, Texas August 3 - 7, 2003: 40-41.
13. **(invited)** Fonda, R.W. and Kral, M.V. The Morphology of Widmanstätten Cementite Laths. Microscopy and Microanalysis, 6, suppl.2, Proceedings: Microscopy and Microanalysis 2000, San Francisco Press, 2000: 342-343.
14. **(invited)** Spanos, G. and Kral, M.V. Three Dimensional Reconstruction and Classification of Ferrite Precipitates. International Conference on Solid-Solid Phase Transformations '99 In Kyoto, Japan, edited by M. Koiwa, K. Otsuka and T. Miyazaki, Japan Institute of Metals, 1999: 1469-1472.
15. **(invited)** Kral, M.V., Mangan, M.A. and Spanos, G. Relating the Crystallography and Morphology of Proeutectoid Widmanstätten Cementite Precipitates. International Conference on Solid-Solid Phase Transformations '99 In Kyoto, Japan, edited by M. Koiwa, K. Otsuka and T. Miyazaki, Japan Institute of Metals, 1999: 1497-1500.
16. Kral, M.V. and Mangan, M.A. The Morphology and Crystallography of Proeutectoid Widmanstätten Cementite Precipitates. *Proceedings of The 51st IMMA National Conference*, 6-8 July 1998, University of Wollongong, NSW Australia, 1998: 511-516.

17. Lanzagorta, M, Kral, M.V., Swan, J.E., Spanos, G., Rosenberg, R.O. and Kuo, E. Metallurgical Application of Three Dimensional Visualization Techniques. *Proceedings IEEE Visualization '98*, October 18-23, Research Triangle Park, North Carolina: IEEE Computer Society Press, 1998: 487-490.
18. Kral, M.V., Hofmeister, W.H. and Wittig, J.E. Undercooled Rapidly Solidified Titanium-Rare Earth Alloys. *Synthesis/Processing of Lightweight Metallic Materials*, F.H. Froes, C. Suryanarayana and C. M. Ward-Close, eds., TMS, 1995: 27-42.
19. Kral, M.V., Bassler, B.T., W.H. Hofmeister and Wittig, J.E. Microstructures in Rapidly Solidified γ Ti-Al Alloys with Erbium Additions. *Mat. Res. Soc. Symp. Proc.*, 364, 1994: 817-822.
20. Bassler, B.T., Hofmeister, W.H., Kral, M.V. and Bayuzick, R.J. The Effect of Erbium Additions on the Solidification Behavior of Gamma Titanium Aluminum. *Mat. Res. Soc. Symp. Proc.*, 364, 1994: 1011-1016.

BOOK CHAPTERS

1. Kral, M.V., Ice, G.E., Miller, M.K., Uchic, M.D. and Rosenberg, R.O. "Three-Dimensional Microscopy" Invited contribution to ASM International Metallography and Microstructures Handbook (Volume 9) under the direction of the ASM Handbook Committee. George Vander Voort, editor. 448-467 (2004).
2. Spanos, G. and Kral, M.V. "Proeutectoid Cementite" Invited contribution to Second Edition of the Encyclopedia of Materials: Science and Technology, Elsevier Science Ltd., Oxford, U.K., Principal Editors K. H. J. Buschow, R. W. Cahn, M. C. Flemings, B. Ilshner, E. J. Kramer and S. Mahajan pp. 7893-7898 (2001).

THESES

1. "Fundamental Studies of Creep in Magnesium Alloys", Takanori Sato, University of Canterbury PhD Thesis 2008.
2. "3D Analysis of Creep Voids in Hydrogen Reformer Tubes", Azmi Abdul Wahab, University of Canterbury Ph.D. Thesis 2007.
3. "High Temperature Corrosion of Stainless Steels", Franziska Jones, University of Canterbury Masters Thesis 2007.
4. "The Selection and Testing of Compression Seal and Chamber Coating Materials For the Pivotal Engine", David J. Miller, University of Canterbury Masters Thesis 2006.
5. "Design of a 3-Axis Wear Testing Device", Benjamin Low, University of Canterbury Masters Thesis 2006.
6. "Characterization of Intermetallics in AL 6xxx Alloys", Khalid Alshahi, University of Canterbury Masters Project Report 2005.
7. "Modification of Aluminum-Silicon Casting Alloys by Minor Alloying Additions", H. R. McIntyre, University of Canterbury Masters Thesis 2004.
8. "3-Dimensional Analysis of Proeutectoid Cementite Precipitate Morphologies", C.-Y. Hung, University of Canterbury Masters Thesis 2002.

PRESENTATIONS

1. Spanos, G. and Kral, M.V. The Proeutectoid Cementite Transformation, Materials Science & Technology 2008 Conference and Exhibit (MS&T '08), Pittsburgh PA USA 5 – 9 October 2008.

2. Drabble, D. and Kral, M.V. Grain Boundary Engineering Alloy 800HT, TMS Annual Meeting 9th March – 13th March 2008 New Orleans LA USA.
3. Sato, T., Mordike, B.L., Nie, J-F. and Kral, M.V., Microstructure Study of Pure Mg and Mg-Al at Various Stages of Creep using EBSD, TMS Annual Meeting Orlando FL USA February 25 – 1 March 2007.
4. Jones, F. and Kral, M.V. The Effect of High Pressure Carburizing and Nitriding Atmospheres on Heat Resistant Alloys at Elevated Temperatures, MS&T 2006 15th – 19th October 2006 Cincinnati OH USA.
5. **(Invited)** Kral, M.V. and Wahab, A.A. A Three Dimensional View of High Temperature Creep Damage, 4th International Workshop on Materials Issues Governing the Performance of Advanced 21st Century Energy Systems 27th February – 1st March 2006 Wellington New Zealand.
6. Kral, M.V. ,Sato, T., Mordike, B.L. and Nie, J-F. Microstructural Study of Magnesium Alloys at Various Stages of Creep, TMS Annual Meeting San Antonio TX USA March 12 - 16 2006.
7. Kral, M.V. and Wahab A.A. 3D Analysis of Early Stages of Creep Void Development, TMS Annual Meeting San Antonio TX USA March 12 - 16 2006.
8. Miller, D.J. and Kral, M.V. Improving Wear Properties of Pivotal Engine Seals; World Tribology Conference III 12 – 16 September 2005 Washington DC.
9. **(Invited)** Kral, M.V. and Wahab, A. Three-dimensional analysis of Creep Voids; Microscopy and Microanalysis 2005 31 July – 5 August 2005, Honolulu HI.
10. Sato, T., Mordike, B.L., Nie, J-F. and Kral, M.V. An Electron Microscope Study of Intermetallic Phases in AZ91 Variants; TMS Annual Meeting San Francisco CA USA February 13 - 17 2005.
11. “Microstructural analysis of modified LM6”, M.V. Kral, New Zealand Metals Industry Conference, 11 November 2004, Christchurch New Zealand.
12. “EBSD Analysis of Proeutectoid Widmanstätten Cementite in Austenitic Steel”, Materials Science and Technology 2004, New Orleans LA USA, 26-29 September 2004.
13. “Identification of Iron-rich Intermetallics in Al-Si Casting Alloys using EBSD”, Materials Science and Technology 2004, New Orleans LA USA, 26-29 September 2004.
14. “Three-dimensional Analysis of Creep Voids in Hydrogen Reformer Tubes”, Materials Science and Technology 2004, New Orleans LA USA, 26-29 September 2004.
15. “Improving Tensile Strength and Elongation in LM6”, M.V. Kral, Casting Technology New Zealand Canterbury Branch September Meeting, 14 September 2004, Christchurch New Zealand.
16. “ELO Growth Of Zinc Oxide On Sapphire Using RF-PAMBE”, W.C.T. Lee, E.D. Walsby, P. Miller, R.J. Blaikie, M.V. Kral, R.J. Reeves, and S.M. Durbin, The 3rd International ZnO Workshop , 5th - 8th October, 2004, Sendai, Japan.
17. “Effects of Simultaneous Na and Sr Additions in a Eutectic Al-Si Casting Alloy”, H.R. McIntyre, M.V Kral and J. Looij, 2004 TMS Annual Meeting, Symposium on Solidification of Aluminum Alloys, 14 – 18 March 2004.
18. **(Invited)** “Interfacial Structure of Cementite Dendrites Formed at Austenite Grain Boundaries” M.V. Kral and G. Spanos, 2004 TMS Annual Meeting, Hume-Rothery Symposium, 14 – 18 March 2004.
19. **(Invited)** “3-Dimensional Analysis of Engineering Materials”, M. V. Kral, Pacific Northwest National Laboratory, Richland Washington, August 18, 2003.
20. **(Invited)** “3-Dimensional Analysis of Engineering Materials”, M. V. Kral, Portland State University, Portland Oregon, July 28, 2003.
21. “Enhancement of the properties of Mg-Li alloys by small alloying additions”, Song, G.S., Staiger, M.S and Kral, M.V., Symposium on Magnesium Technology held at the TMS Annual Meeting 2003, San Diego, CA USA 2 – 6 March 2003.
22. “Lattice Strain in the presence of strengthening-phase precipitates in beta-phase magnesium-lithium alloys containing aluminium and beryllium” G.S. Song, M. Staiger and M.V. Kral, Light Metals Technology 2003, Brisbane Australia, 18 – 20 September 2003.
23. “3-Dimensional Analysis of Coarse Martensite in Low Carbon Steel”, Archana Gupta, Milo V. Kral, George Spanos, Symposium on 3-Dimensional Materials Science held at the Fall 2003 TMS meeting in Chicago, IL, November 9 - 12, 2003.
24. **(Invited)** "The Structure Of Widmanstätten Cementite Laths", Richard W. Fonda, William T.

- Reynolds, Milo V. Kral, Symposium on Austenite Formation and Decomposition, held at the Fall 2003 TMS meeting in Chicago, IL, November 9 - 12, 2003.
25. **(Invited)** "The Proeutectoid Cementite Transformation", G. Spanos and M. V. Kral, Symposium on Austenite Formation and Decomposition, held at the Fall 2003 TMS meeting in Chicago, IL, November 9 - 12, 2003.
 26. "Enhancement of the oxidation resistance of Mg-Li alloys by additional elements", Song, G.S. and Kral, M.V., The Inaugural New Zealand Metals Industry Conference, Rotorua, October 31 - November 2, 2002.
 27. "Solidification modes and aging characteristics in a Mg-rich Mg-Zn-Y alloy", Song, G.S. and Kral, M.V., The Inaugural New Zealand Metals Industry Conference, Rotorua, October 31 - November 2, 2002.
 28. "Serial Sectioning and 3D Reconstruction of Engineering Materials", TMS Fall Meeting 2002, Columbus OH, October 6-10 2002.
 29. **(Invited)** "Engineering Materials at Canterbury", University of Canterbury Department of Chemistry, 10 June 2002.
 30. "Grain Boundary Cementite in Austenite", Kral, M.V., TMS Fall Meeting 2001, Indianapolis IN, 4 - 8 November 2001.
 31. **(Invited)** "Toward a Complete Description of Proeutectoid Cementite", Kral, M.V., Carnegie-Mellon University, Pittsburgh PA October 29 2001.
 32. "Three Dimensional Reconstruction And Modeling Of A Porous Tantalum Biomaterial", Gunson, A.J., Poggie, R.A., Kral, M.V., Society for Biomaterials 27th Annual Meeting, St Paul Minnesota, April 24-29 2001.
 33. **(Invited)** "Interphase Boundary Precipitation in Titanium-Rare Earth Alloys", Kral, M.V. Department of Materials and Process Engineering, University of Waikato, Hamilton New Zealand 11 April 2001.
 34. "Three-Dimensional Analysis Of Proeutectoid Cementite Precipitate Morphologies", Hung, C and Kral, M.V., 2001 Joint Conference Of SCENZ / FEANZ / EMG, Auckland New Zealand 9-10 April 2001.
 35. "Relating Crystal Orientations With Shapes Using TEM", Kral, M.V., 2001 Joint Conference Of SCENZ / FEANZ / EMG, Auckland New Zealand April 9-10 2001.
 36. (Video) "Three-Dimensional Analysis of Microstructures"; Kral, M.V., Spanos, G. and Rosenberg, R.O., produced by US Naval Research Laboratory, Physical Metallurgy Branch and Visualization Laboratory, Washington DC (2001).
 37. "Toward a Complete Description of Proeutectoid Cementite", Kral, M.V., Monash University, Clayton Australia, 15 December (2000).
 38. (Invited) "The Morphology of Widmanstätten Cementite Laths", Microscopy and Microanalysis 2000, Fonda, R.W. and Kral, M.V. in Philadelphia, PA, Aug. 13 - Aug. 17 (2000).
 39. "Relating Precipitate Shapes, Orientations And Crystallography", Microscopy and Microanalysis in Engineering Materials, Kral, M.V. and Fonda, R.W., Monash University, Australia, Feb. 14 - 17 (2000).
 40. (Invited) "Three-Dimensional Analysis of Microstructures"; Kral, M.V., Mangan, M.A., Spanos, G. and Rosenberg, R.O., National Institute of Standards and Technology, Gaithersburg, Maryland, USA, December 10 (1999).
 41. (Invited) "Three-Dimensional Analysis of Microstructures"; Kral, M.V., Mangan, M.A., Spanos, G. and Rosenberg, R.O., 1999 Meeting of the International Metallographic Society in Cincinnati, Ohio, USA, October 31-Nov. 4 (1999).
 42. "Three-Dimensional Visualization and Analysis of Microstructure"; Spanos, G., Rosenberg, R.O. and Kral, M.V.; 1999 TMS Fall Meeting, 1 - 5 Nov., Cincinnati, OH (1999).
 43. "Correlation between the Crystallography and 3-D Morphology of Proeutectoid Widmanstätten Cementite Precipitates"; Mangan, M.A., Kral, M.V., Spanos, G., 1999 TMS Fall Meeting, 1 - 5 Nov., Cincinnati, OH (1999).
 44. "The Morphology And Crystallography Of Cementite Precipitates"; Kral, M.V, Mangan, M.A. and Spanos, G., International Conference On Solid-Solid Phase Transformations '99 In Kyoto, Japan (1999).
 45. "Three Dimensional Reconstruction And Classification Of Ferrite Precipitates"; Kral, M.V. and Spanos, G., International Conference On Solid-Solid Phase Transformations '99 In Kyoto, Japan

- (1999).
46. (Best paper/presentation award) "The Morphology of Widmanstätten Cementite"; Kral, M.V., Mangan, M.A. and Spanos, G.; Materials 98 – The 51st IMMA National Conference, 6-8 July 1998, University of Wollongong, NSW Australia.
 47. "Three Dimensional Analysis of Proeutectoid Precipitates in Alloy Steels"; Kral, M.V., Mangan, M.A. and Spanos, G.; Monash University Materials Science Departmental Seminar, Monash Australia (1998).
 48. "Three Dimensional Reconstruction of Proeutectoid Precipitates in Alloy Steels"; Kral, M.V. and Spanos, G.; TMS 1998 Annual Meeting and Exhibition, 14 - 18 February 1998, San Antonio TX.
 49. (invited) "Three-Dimensional Analysis of Microstructures", Kral, M.V. and Spanos, G., Gordon Research Conference, Microstructural Design, Processing and Properties of Materials for High Performance Applications, Holderness School, Plymouth, New Hampshire, USA June 21-26, 1998.
 50. (invited) "Three-Dimensional Analysis of Microstructures", Kral, M.V. and Spanos, G., Case Western Reserve University Materials Science and Engineering Department colloquium seminar series, 17 March 1998, Cleveland, OH.
 51. (invited) "Three-Dimensional Analysis of Cementite Precipitates", Kral, M.V. and Spanos, G., Carnegie Mellon University Materials Science and Engineering Department colloquium seminar series, 14 October 1997, Pittsburgh, PA.
 52. "Solid State Dendritic Grain Boundary Precipitates"; Kral, M.V. and Spanos, G.; ASM-TMS Materials Week 1997, 14 - 18 September 1997, Indianapolis IN.
 53. "Three Dimensional Analysis of Cementite Precipitates"; Kral, M.V. and Spanos, G.; ASM-TMS Materials Week 1997, 14 - 18 September 1997, Indianapolis IN.
 54. "Three Dimensional Analysis of Microstructures"; Kral, M.V. and Spanos, G.; University of Canterbury, 8 July 1997, Christchurch New Zealand.
 55. "Continuous Cooling Transformation Diagrams for Advanced Navy Welding Consumables and Base Plate Steels", Spanos, G., Vandermeer, R.A., Fonda, R.W. and Kral, M.V. Concurrent Technologies Corporation, 3 April 1997, Johnstown, PA.
 56. "Three Dimensional Analysis of Precipitates"; Kral, M.V. and Spanos, G.; Concurrent Technologies Corporation, 3 April 1997, Johnstown PA.
 57. "Interfacial Structure, Growth, and Three Dimensional Morphology of Proeutectoid Cementite Plates", Spanos, G., Kral, M.V., Moore, P.G. and Howe, J.M., TMS-AIME fall meeting, 7 - 10 Oct. 1996, Cincinnati, OH.
 58. "Precipitation in Undercooled, Rapidly Solidified Titanium Rare Earth Alloys"; Kral, M.V., Hofmeister, W.H. and Wittig; J.E., ASM-TMS Materials Week 1996, 7 - 10 October, Cincinnati OH.
 59. "Processing Considerations and Microstructures in Undercooled Rapidly Solidified Titanium-Rare Earth Alloys"; Kral, M.V., Hofmeister, W.H. and Wittig; J.E., TMS 1995 Annual Meeting and Exhibition, 12 - 16 February, Las Vegas NV.
 60. "The Effect of Erbium Additions on the Solidification Behavior of Gamma Titanium Aluminum"; Bassler, B.T., Hofmeister, W.H., Kral, M.V. and Bayuzick, R.J.; 1994 Fall Meeting of the Materials Research Society, 28 November - 2 December, Boston, MA.
 61. "Microstructures in Rapidly Solidified Gamma Titanium Aluminum Alloys Kral, M.V., Hofmeister, W.H. and Wittig; J.E., 1994 Fall Meeting of the Materials Research Society, 28 November - 2 December, Boston, MA.
 62. "Erosion Resistance of Diamond Coatings", Kral, M.V., Davidson, J.L. and Wert, J.J.; 9th International Wear of Materials Conference, 13-16 April 1993, San Francisco, CA.

INTERNAL REPORTS (including but not limited to)

Investigation of Weld Microstructures in Aluminum Lithium Alloys. (with Shah, S., Hahn, G. T., and Wittig, J.E.) Martin Marietta (1992).

Investigation of Materials Selection for River Lock Gate Applications, (with Wert, J.J., Morton, C.W. and Parrish, R.) Ohio River System Army Corps of Engineers internal report (1996).

Analysis of Cracked Welded Assembly (1999).

Analysis of Fractured Shaft (1999).

Failure of Water Sprinkler Head (2000).

Failure of a Heater Power Cord (2000).

Dimensional Analysis of Printed Circuit Boards (PCBs) (2000).

Failure Analysis of Fractured Springs (2000).

Feasibility Study for Rotor Molded Polyethylene Wine Barrel Racks (with Whybrew, K.) (2000).

Microstructural Analysis of Heat Resistant Materials (2000).

Analysis of Joining Tool (2001).

Analysis of PCB coating thickness (2001).

Analysis of Hot Dip Galvanized Coatings (2001).

Analysis of Enamel Coatings for Appliances (2001).

Analysis of Solder Coatings (2001).

Failure Analysis Defects in Aluminum Castings (2001).

Environmental Stress Cracking of Polycarbonate (2002)

Feasibility Study of Tire Recycling Concept for Recovered Materials Foundation (2002)

Bolt and Washer Property Validation (2002)

Failure Analysis of a Co-Cr Replacement Knee Component (2002)

Failure Analysis of Ti-6Al-4V Replacement Knee Components (2002)

Optimizing Mechanical Properties of Aluminum Castings (2002).

Contamination of Sintered Biomaterials (2002).

Fracture Characteristics of a Novel Biomaterial (2002).

Phase Identification in Cryogenically Treated Steel (2002).

Investigation of Trailer Failure (2002).

Optimization of LM6 Casting Procedures (2002).

Heat Treatment of CF8M Steel (2003).

Materials Selection of Smelter Tapping Pipe (2003).

Analysis of Aluminum Alloy 5083 Hull Corrosion (2003).

Characterization of Ball Grid Array (2004).

Impeller Failure Analysis (2004).

Heat Exchanger Tube Failure Analysis at Wairakei Power Station (2004).

Solder Joint Analysis (2004).

Environmentally assisted cracking of Plastics (2004).

Solder Joint Analysis (2004).
Failure of Plastic Components (2005 - 2006).
Process Improvement in Aluminum Foundry (2006).
Failure Analysis of a Large Roller Bearing (2006).
Failure Analysis of Large Cast Iron Pipes used in the Aluminum Smelting Industry (2006).
Analysis of Pb-free Solder Joints (2005-2006).
Failure Analysis of a shackle for an Americas Cup contender (2007).
Failure analysis of a skiing chair lift safety bar (2007).
Failure analysis of a transmission case (2007).
Corrosion analysis of fencing materials (2007).
Process optimization for bronze extrusions (2007).
Analysis of creep failure of a high temperature steel (2007).