



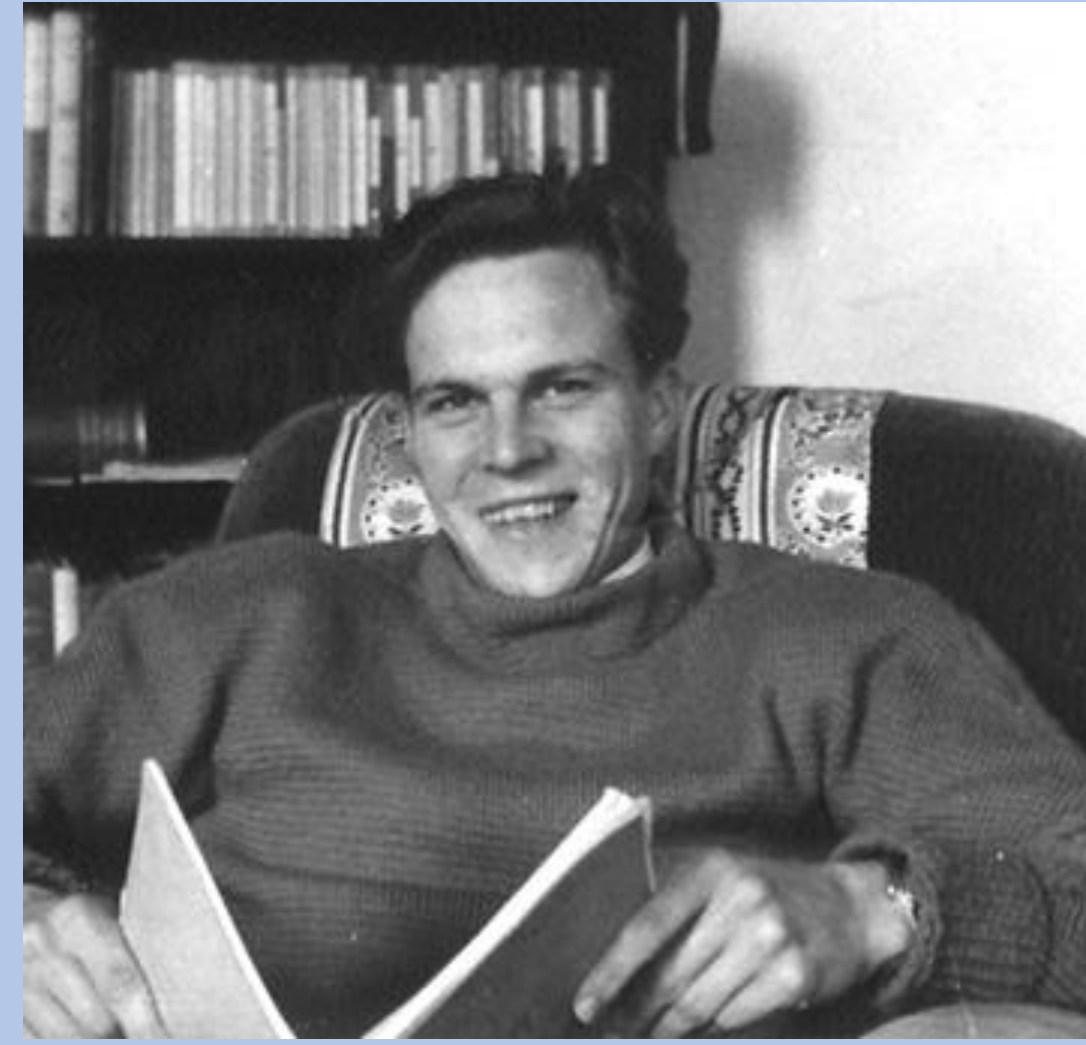
Terence E. Mitchell

1937-2022



Background

Dr. Terence E. Mitchell was born in Haywards Heath, Sussex, England in 1937. Terry received his B.A., M.A., and Ph.D. in Physics, and did his post-doc at the Cavendish Lab at the University of Cambridge. His adviser was Sir Peter Hirsch, one of the pioneers of transmission electron microscopy. In 1963, he emigrated to the United States and joined the Department of Metallurgy (now the Department of Materials Science and Engineering) at Case Institute of Technology (now Case Western Reserve University), where he later became Department Chairman and Director of the High Voltage Electron Microscope Facility. He mentored many students at Case, some of whom (e.g. S.S. Hecker, LANL Director from 1986-1997) encouraged him to relocate to New Mexico. In 1987 he moved to Los Alamos National Laboratory, where he worked until his retirement in 2002. He passed away on October 22, 2022.



Honors and Awards

Terry was the President of MSA in 1995, the MSA Distinguished Physical Scientist in 2007 and amongst the inaugural class of MSA Fellows in 2009. He was also a Fellow of the American Society of Metals (1987), Fellow of Los Alamos National Laboratory (1990), Fellow of ACerS (1991), Fellow of American Physical Society (1992), Fellow of The Minerals, Metals and Materials Society (TMS) (1997) and Fellow of the Japan Institute of Materials Society (2004).

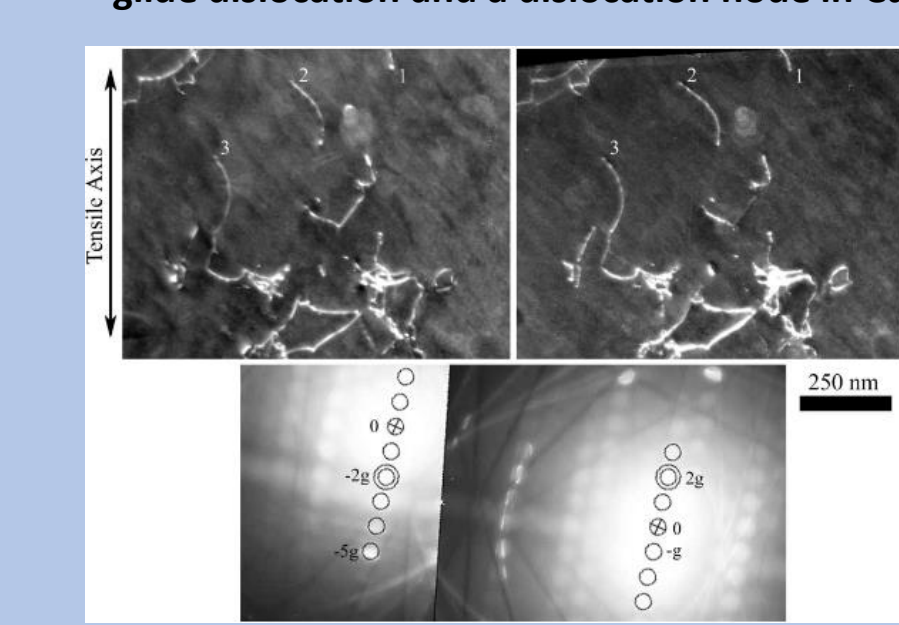
Work Hardening in FCC Metals

The dependence of cross-slip and stacking-fault energy in FCC metals on alloys

ABSTRACT
The results of an experimental study of the temperature and strain-rate dependence of $\sigma_{0.2}$ for Cu-Zn alloys are described and interpreted in terms of Seeger's theoretical analysis of $\sigma_{0.2}$. The values of the stacking-fault energy, γ , derived in this way are compared with the estimates of γ for the same alloys obtained directly from electron microscope observations of dislocation motion. The two sets of values are found to disagree, and the nature of the discrepancy is such as to show that dislocations on the slip plane of the Seeger analysis to Cu-based alloys with $\sigma_{0.2} > 110$. The lower limits of γ for pure Cu and Ag, from electron microscope data, are ~ 40 erg/cm² and ~ 20 erg/cm², respectively. The values of γ deduced from Seeger's analysis are ~ 170 erg/cm² and ~ 80 erg/cm², respectively. The lower limit of γ for Cu is consistent with the previously accepted figure based on the assumption that γ is twice the twin boundary energy, and this assumption is now held to be invalid. Seeger's model of cross-slip at Lomer-Cottrell barriers is examined critically, and found to be incompatible with the observations in Cu and Ag that screws are held up preferentially. It is proposed that screws are stopped by becoming heavily jogged in the cross slip planes observed by transmission microscopy, and that cross-slip occurs at these jogs by processes controlled by jogs.

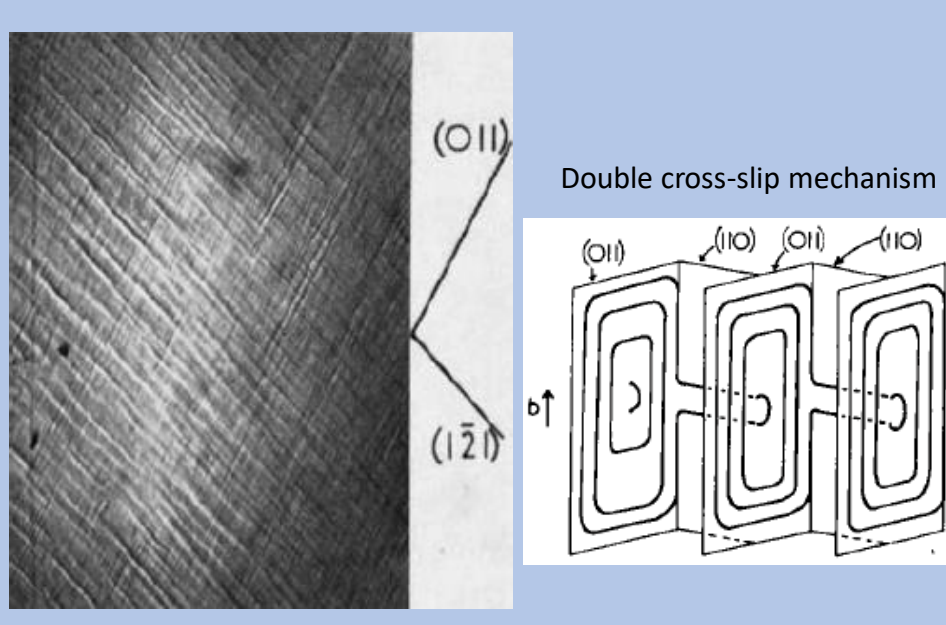
P. R. Thornton, T. E. Mitchell & P. B. Hirsch, Philosophical Magazine, 7 (1962), 1349-1369.

WB and Stereo-TEM study of the interaction between a glide dislocation and a dislocation node in Cu



R.J. McCabe, A. Misra, T.E. Mitchell, Philosophical Magazine, 83 (2003) 4123-29

Work hardening in niobium single crystals

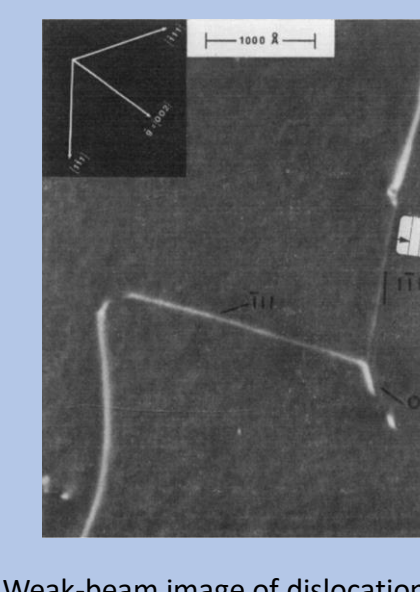


T. E. Mitchell, R. A. Foxall, P. B. Hirsch, Philosophical Magazine, 8 (1963) 1895-1920.

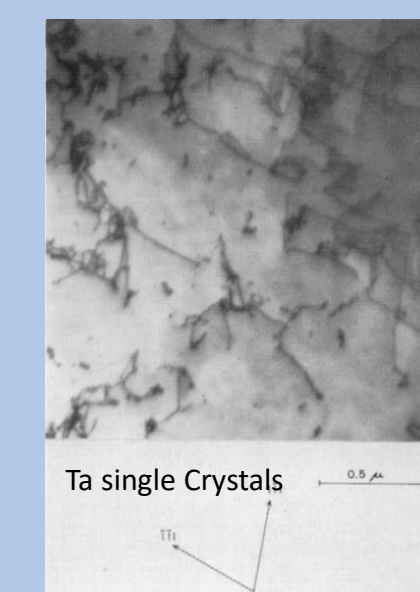
BCC Refractory Metals: Dislocations and Solid-Solution Hardening and Softening



Interstitial and Substitutional Solution Hardening and Softening in BCC Metals, V.K. Sethi, R. Gibala, T.E. Mitchell, Dislocations in Solids, 1st edition (1985).



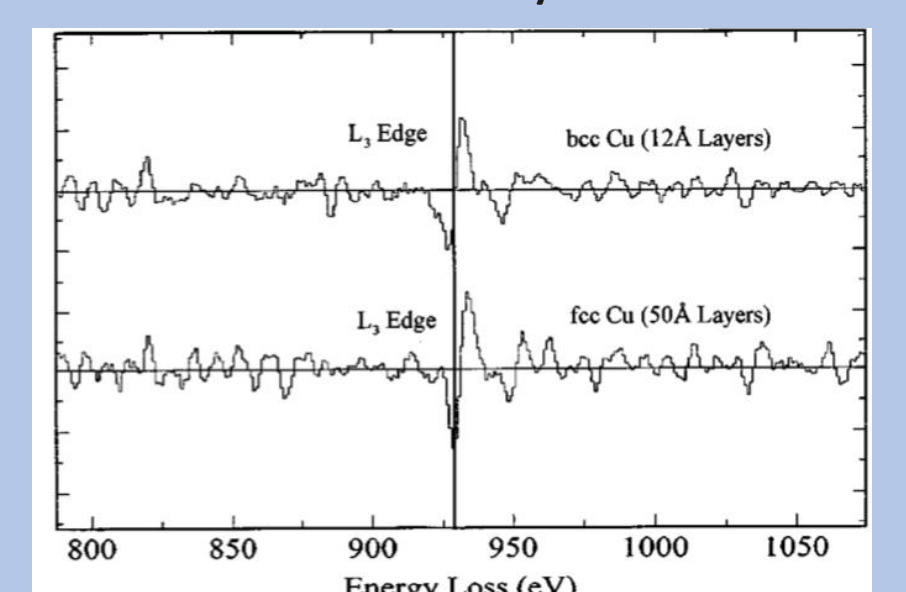
Weak-beam image of dislocations in a Ta-150 at. ppm N alloy deformed at 77 K. $\langle 111 \rangle$ -screw and $\langle 010 \rangle$ -reaction dislocations are marked. [G. Welsch, R. Gibala, T.E. Mitchell, Acta Metall., 23 (1975) 1461].



W.A. Spitzig, T.E. Mitchell, Acta Metall., 1311 (1966)

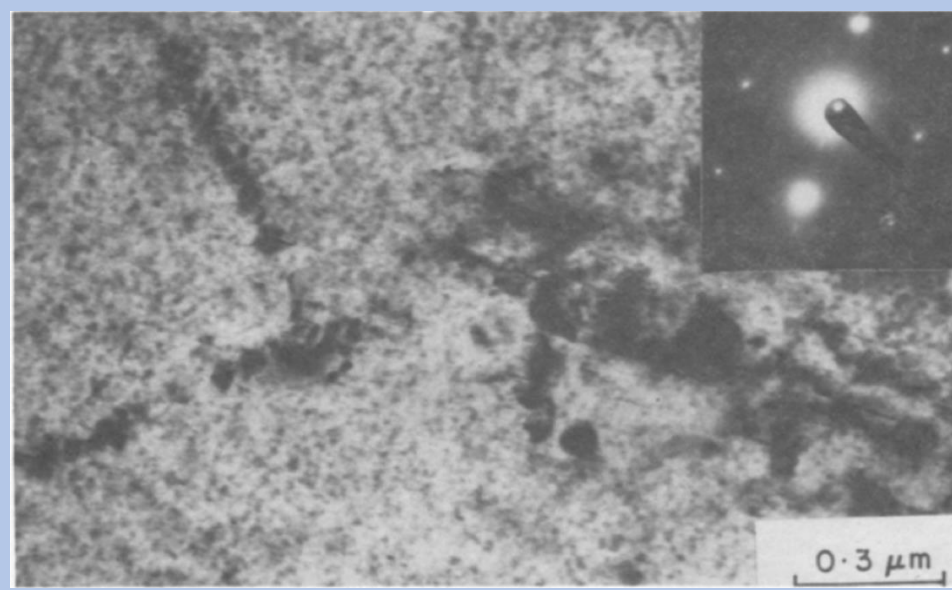
Metallic Multilayers

BCC Cu in Cu/Nb



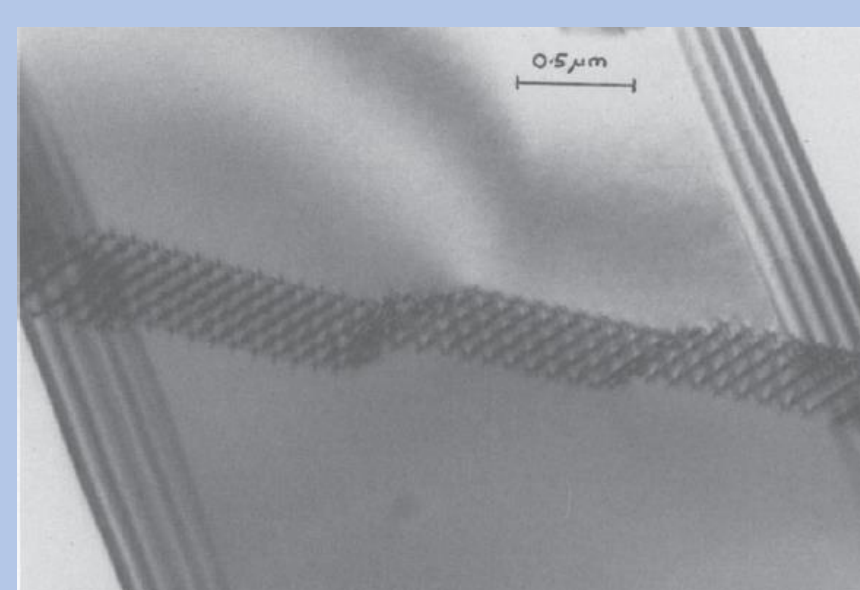
Second difference PEELS spectra of Cu L3 edges from fcc and bcc Cu. The bcc Cu shows a 2 eV shift in the L3 edge position as compared with fcc Cu. [H. Kung, T. E. Mitchell, J.D. Embury, et al., Appl. Phys. Lett., 71 (1997) 2103]

Pioneering Research in High Voltage TEM

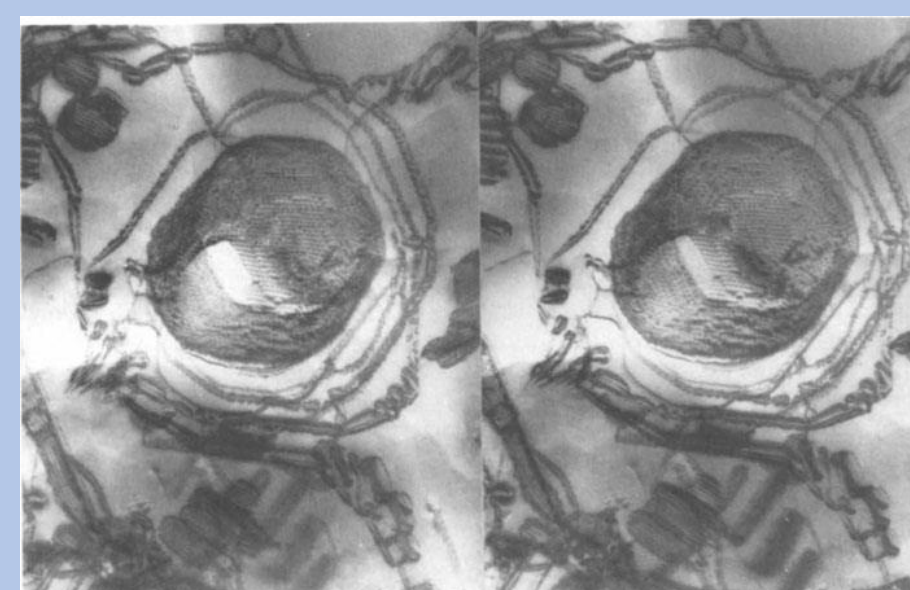


Al-48 Cu alloy solution treated and annealed. Irradiated 60 minutes under high flux conditions during heating for 300 minutes at 200°C. Reaction along $\langle 100 \rangle$ and extra spots at $\langle 110 \rangle$ positions in the selected area diffraction patterns are due to the presence of σ' . Large σ' precipitates nucleated at dislocations.

P.S. Sklad and T.E. Mitchell, Scripta Metall., 8 (1974) 1113



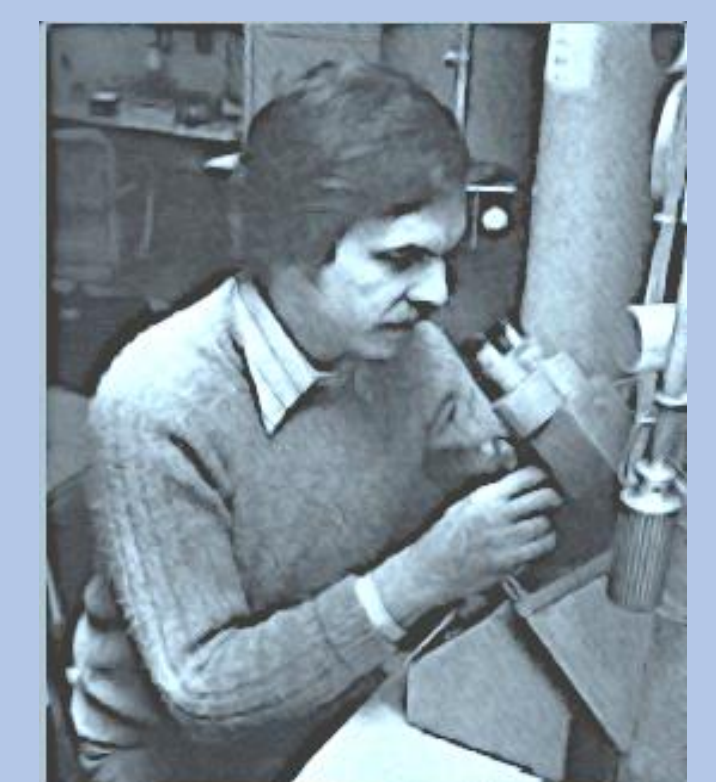
TEM (650 kV) of a small-angle grain boundary crossing a twin in orthorhombic yttrium aluminum oxide. The twin boundaries are parallel to $\langle 110 \rangle$ and twinning involves the interchange of the a and b axes.



Pair of stereo electron micrographs (800 kV) of hematite precipitates in ilmenite. Stereo viewing reveals that the large particle is spherical and enclosed by an interface dislocation network.

FIFTH INTERNATIONAL CONFERENCE ON HIGH VOLTAGE ELECTRON MICROSCOPY KYOTO, JAPAN, AUGUST 29-SEPTEMBER 1, 1977

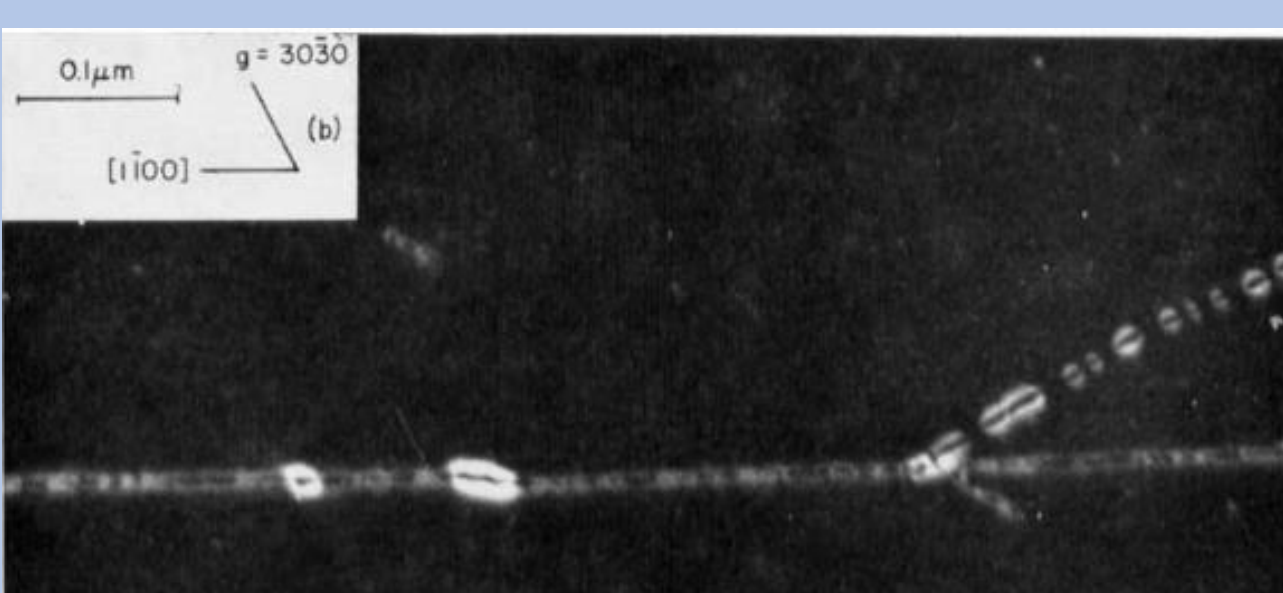
HYDM STUDIES OF IRRADIATION DAMAGE IN OXIDES
T. E. Mitchell, R. S. Barnard, D. G. Rowlett and L. W. Hobbs
Department of Metallurgy and Materials Science
Case Western Reserve University
Cleveland, Ohio 44106, USA



TEM using the Case Hitachi HVEM ca. 1970

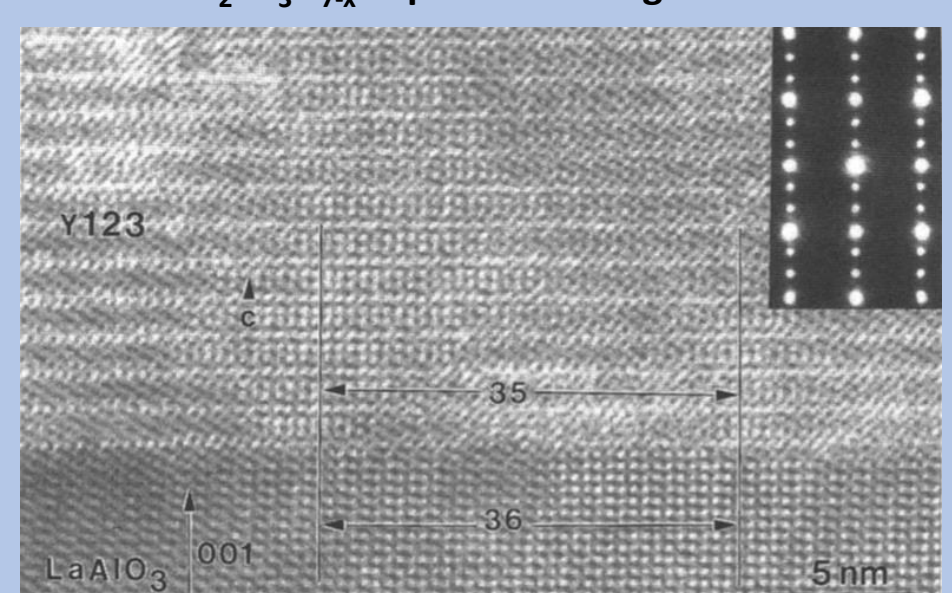
Structural and Functional Ceramics

Climb Dissociation of Dislocations in Sapphire

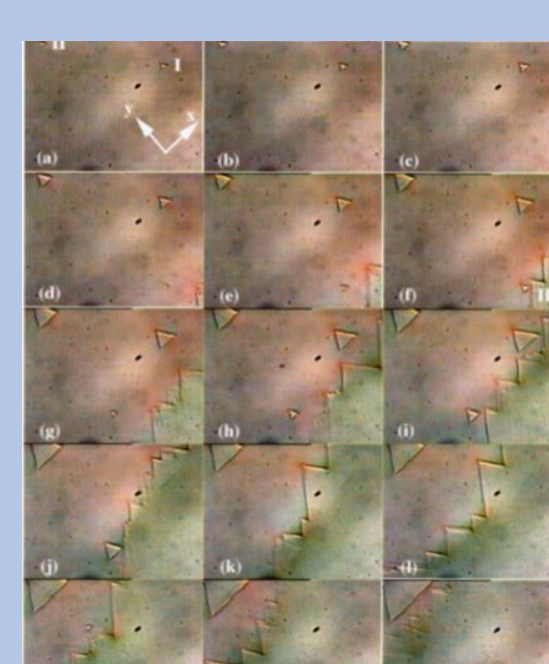


T. E. Mitchell, B.J. Pletka, D.S. Phillips, A.H. Heuer, Philosophical Magazine, 34 (1976), 441-451

HRTEM of YBa₂Cu₃O_{7-x} superconducting thin film on LaAlO₃

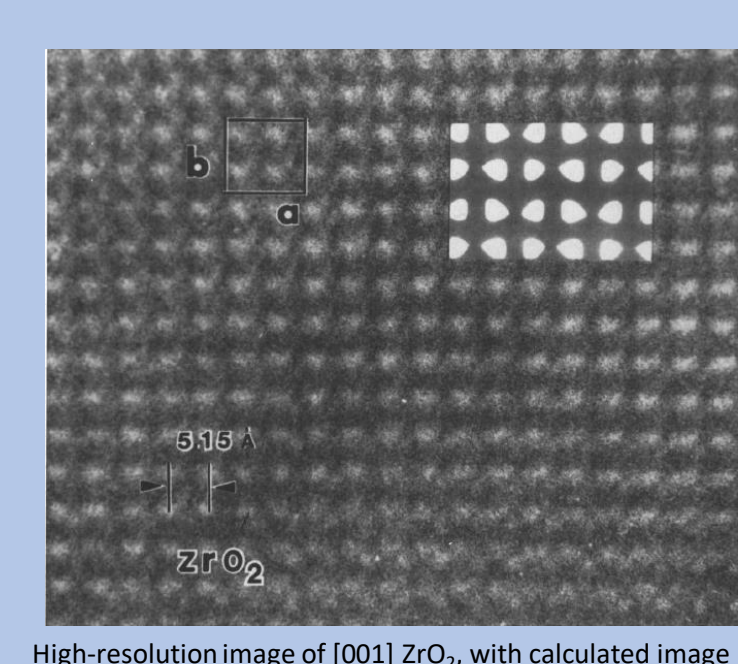


S.N. Basu, A.H. Carim, T.E. Mitchell, J. Mater. Res., 6 (1991) 1823



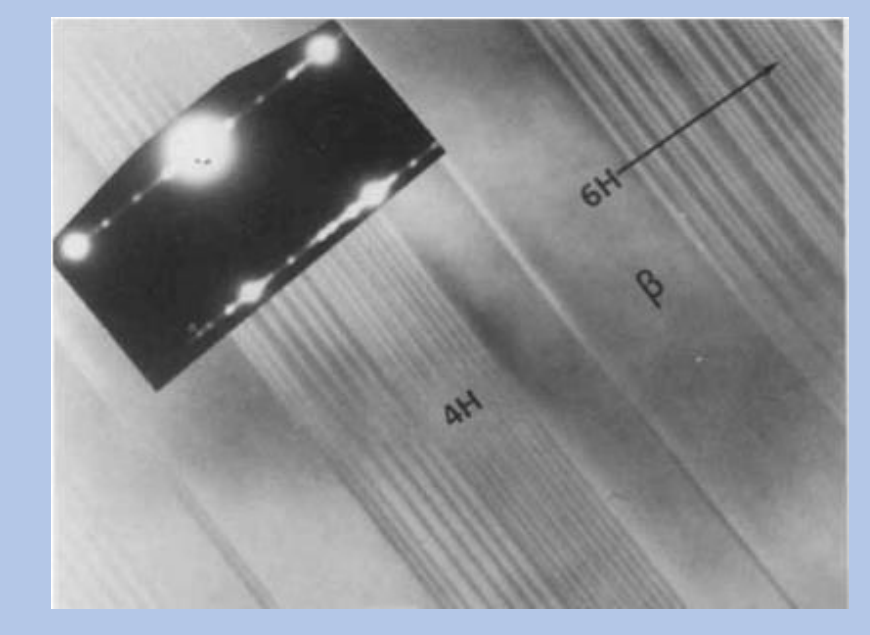
In situ video observation of 180° domain switching in LiTaO₃ by electro-optic imaging microscopy

V. Gopalan, T.E. Mitchell
J. Appl. Phys., 85 (1999) 2304



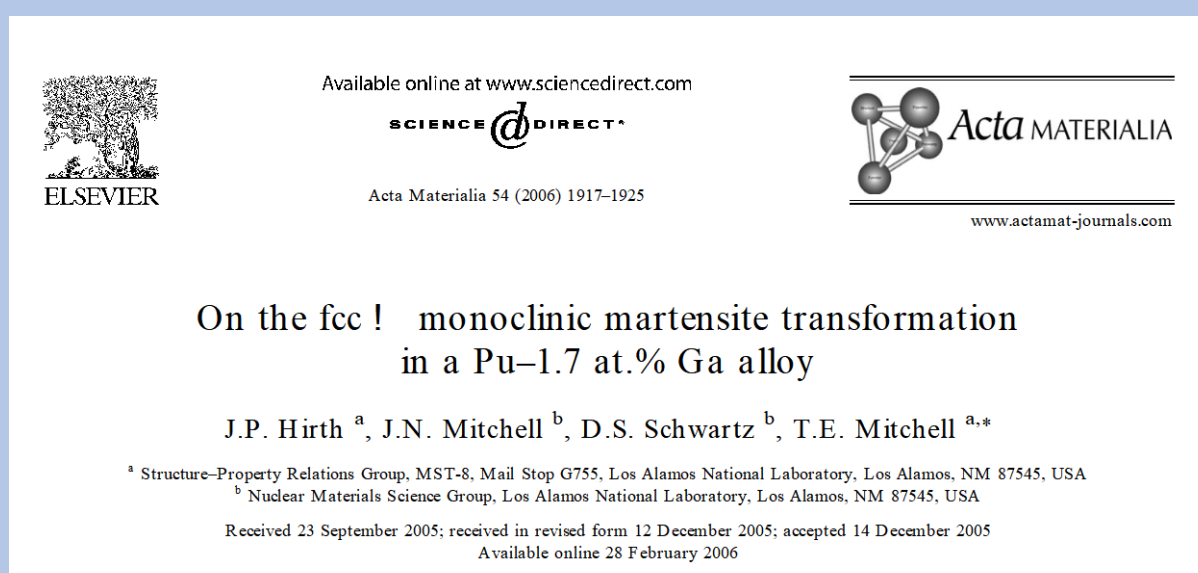
High-resolution image of $\langle 001 \rangle$ ZrO₂, with calculated image match. The unit cell is shown. [A.H. Heuer, T.E. Mitchell, et al., Ultramicroscopy, 1985]

Polymorphs in α -SiC

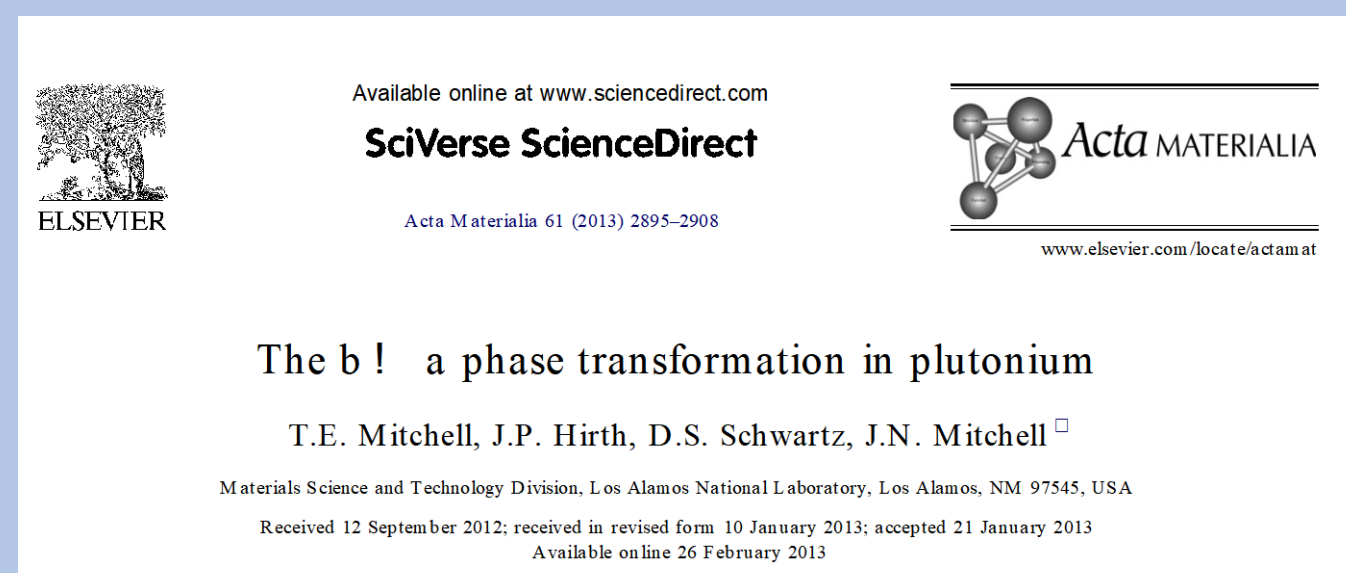


L.U. Ogbui, T.E. Mitchell and A.H. Heuer, J. Amer. Ceramic Society, 64 (1981).

Actinides

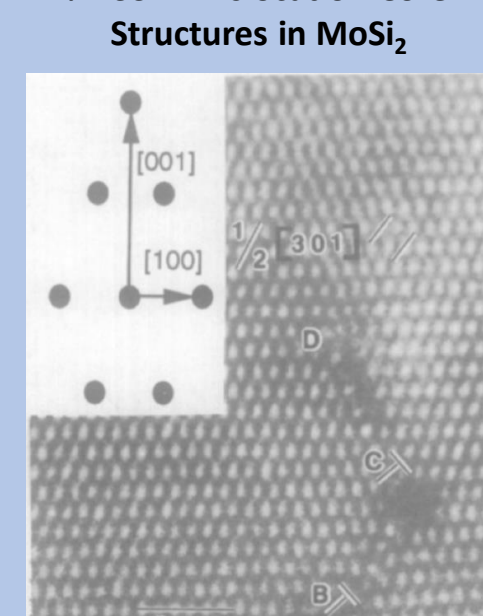


After retirement, he studied plutonium phase transformations with his son Jeremy.



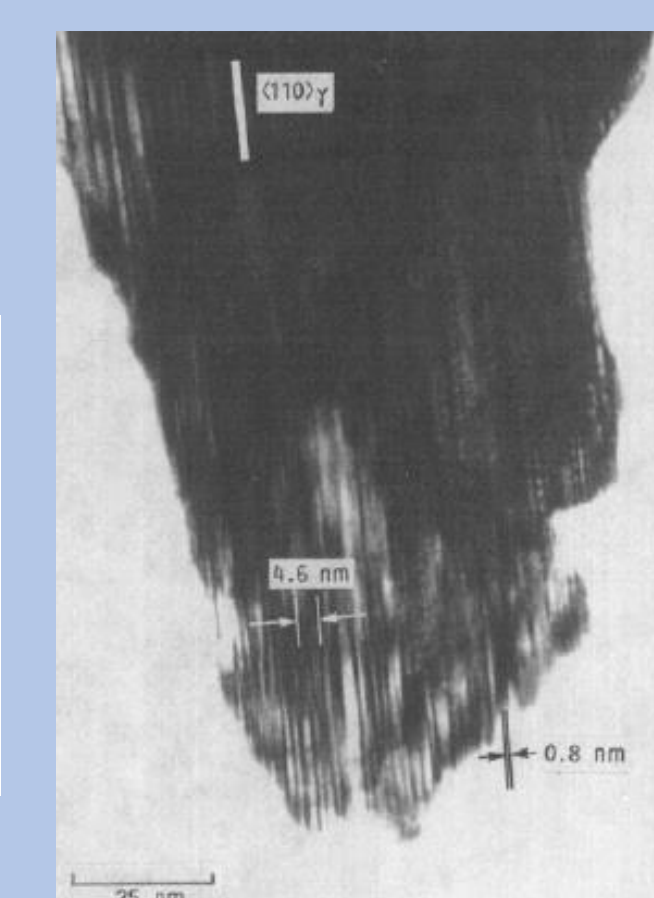
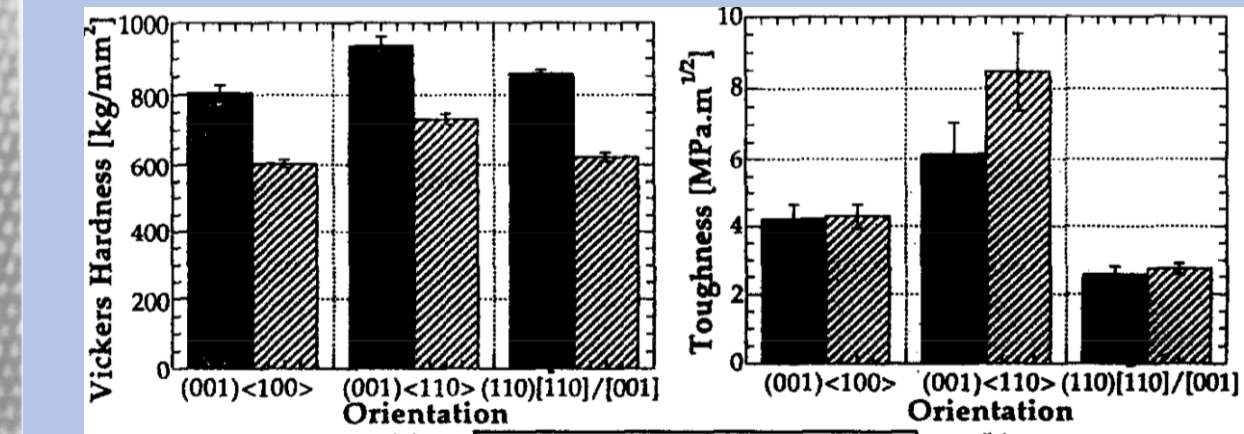
Intermetallics

$\frac{1}{2}\langle 311 \rangle$ Dislocation Core Structures in MoSi₂



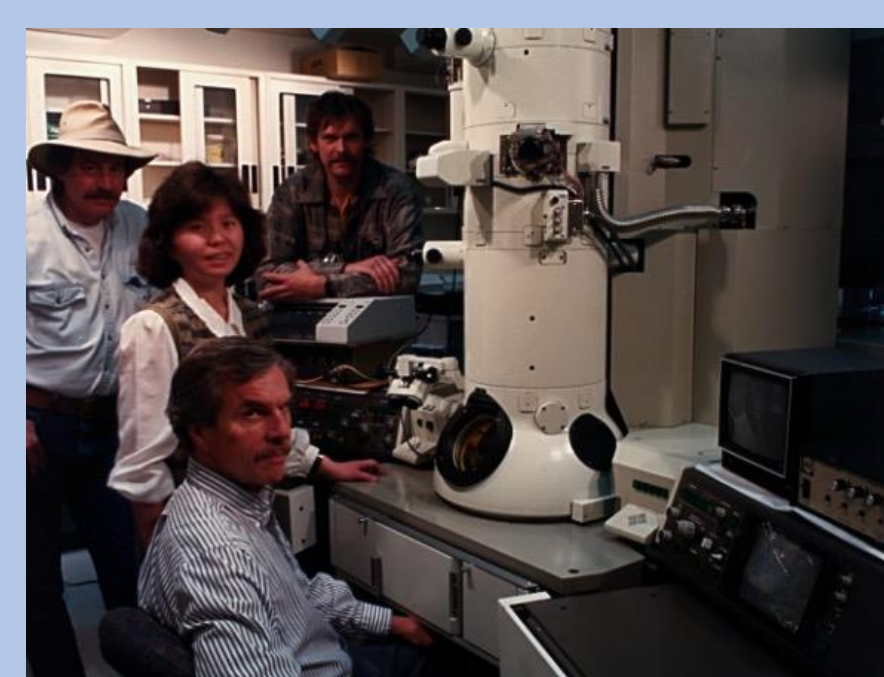
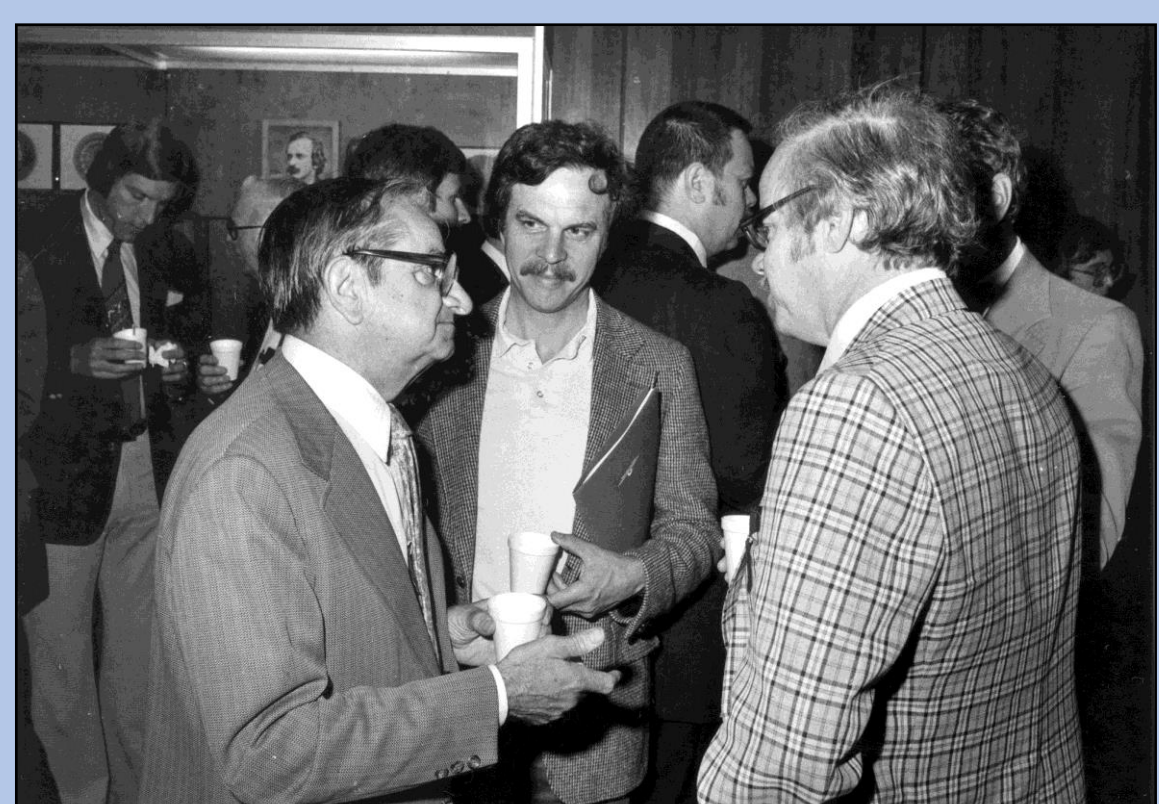
SA Maloy, T.E. Mitchell, A.H. Heuer, Acta Metall. Mater., 43 (1995), 657-668

Effect of small aluminum additions on mechanical, elastic and structural properties of monocrystalline C11₁MoSi₂



Al₂O₃ oxide scale on NiAl
J. Doychak, J.L. Smialek, and T.E. Mitchell, Metall. Trans. A, 20 (1989) 499.

Colleagues and Friends



Retirement

Terry retired from LANL in 2002. Then, he and his wife Marion fully devoted themselves to exploring the western U.S. and Canada. Later, they began exploring near-polar and polar regions, with trips to Alaska, Svalbaard, Patagonia, and Iceland, and Antarctica. He was an adventurous soul for his entire life.



Awards and Honors

- 1987, Fellow of the American Society of Metals and Materials (ASM)
- 1990, Fellow of the Los Alamos National Laboratory
- 1991, Fellow of the American Ceramic Society
- 1992, Fellow of the American Physical Society
- 1994, Honorary Sc. D. from the University of Cambridge
- 1995, President, Microscopy Society of America (MSA)
- 1996, Fellow of The Minerals, Metals and Materials Society (TMS)
- 2004, Fellow of the Japan Institute of Materials Society
- 2007, MSA Distinguished Physical Scientist
- 2009, Fellow (inaugural class) of the Microscopy Society of America (MSA)
- 60th Birthday Symposium at LANL and a special issue of Philosophical Magazine A (Sept. 1998)
- 65th Birthday Honorary Symposium, 2003 TMS Annual Meeting, San Diego, CA.

PHILOSOPHICAL MAGAZINE A, 1998, VOL. 78, NO. 3, 525-526

An appreciation of Dr T. E. Mitchell on his 60th birthday
P. B. HIRSCH
16 July 1997

A Tribute to Terence E. Mitchell

S.S. HECKER
METALLURGICAL AND MATERIALS TRANSACTIONS A
VOLUME 35A, NOVEMBER 2004

Acknowledgements

Google Scholar: > 425 articles, >17,000 citations, h-index: 70.

Major Source: S. S. Hecker. A Tribute to T.E. Mitchell (forward to Festchrift, Metallurgical and Materials Transactions A, Vol. 35A August 2004—2003

Obituary, Los Alamos Daily Post, via C. Clark, Dec. 7, 2022.

Los Alamos National Laboratory website.