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Editorial

Special issue in honor of Professor James C.M. Li

It has been our privilege to edit this special volume in honor of Professor James C.M. Li for his contributions to Materials Science and Engineering on the occasion of his 80th birthday on 12 April of this year. The topical areas selected for publication were based on the seminal contributions of Professor Li. The papers were scrupulously reviewed for presentation at the TMS Annual Meeting, San Francisco, CA in November 2004. The authors were then requested to submit full journal papers for review before the special session. We thank all the co-editors and reviewers who critically reviewed the papers and suggested appropriate modifications. In the interest of keeping the highest standard and the page constraints, some very good papers had to be declined according to reviewers' advice. We take this opportunity to wish Professor James C.M. Li a good health and long productive life.

Professor James C.M. Li has made seminal contributions to understanding, predicting and controlling mechanical properties of materials. The principal theme of Professor Li's work, that spans a period of 50 years, has been micromechanisms of mechanical behavior in crystalline and amorphous materials. Professor Li's work has covered materials ranging from metals and alloys to ceramics, composites and polymers. The nature of his work has been both theoretical and experimental. The contributions of Professor Li have covered a broad range of activities within the field of mechanical behavior of materials. Among the numerous original inroads into heretofore unchartered territory, the following stand out:

- Seminal work on chemical equilibrium in nonhydrostatically stressed solids.
- The first studies of the effects of dislocation groupings and dislocation stress-field interactions.
- Thermally activated dislocation motion on the mechanical properties of crystalline materials.
- Thermally activated description of plastic flow (e.g. [9]).
- Dislocation dynamics through stress relaxation (e.g. [6,7]).
- Pioneering studies of plasticity of amorphous metals, and postulation of a mechanism for plastic deformation of metallic glasses (e.g. [1–4]).
- He invented the impression creep testing technique and used it to study the mechanisms of creep, fatigue, stress relaxation and strain recovery in materials on a highly localized scale.
- Shear localization in metallic glasses (e.g. [2–4]).
- Mechanism for the grain-size dependence of yield stress using emission of dislocations from grain boundaries (e.g. [5]).

1. J.C.M. Li, in: L.E. Murr, C. Stein (Eds.), Frontiers in Materials Science—Distinguished Lectures, Marcel Dekker, New York, 1976, p. 527.
2. J.C.M. Li, in: Metallic Glass, ASM, Metals Park, OH, 1976, pp. 224–246.
3. J.C.M. Li, Proceedings of the Fourth International Conference on Rapidly Quenched Metals, Sendi, Japan, 1981.
4. J.C.M. Li, Proceedings of the Materials Research Society Symposium on Rapidly Solidified Amorphous and Crystalline Alloys, Boston, 1981.
5. J.C.M. Li, Trans. TMS-AIME 227 (1963) 75.
6. J.C.M. Li, Can. J. Phys. 45 (1967) 493–509.
7. I. Gupta, J.C.M. Li, Metall. Trans. 1 (1970) 2323–2330.
8. P. Zhu, J.C.M. Li, C.T. Liu, Reaction mechanism of combustion synthesis of NiAl, Mater. Sci. Eng. A 329 (2002) 57–68.
9. J.C.M. Li, in: A.R. Rosenfield, G.T. Hahn, A.L. Bement, R.I. Jaffee (Eds.), Dislocation Dynamics, McGraw-Hill, New York, 1968, pp. 87–116.

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In recent years, Professor J.C.M. Li has explored new areas of research including:

- Use of impression testing using micron-sized cylindrical indenters to determine adhesion, creep resistance, viscosity, and the kinetics of stress relaxation.
- Combustion synthesis of intermetallic compounds (e.g. [8]).

Below is a listing of his 25 most highly cited contributions:

1. *Self-diffusion coefficient and viscosity in liquids*, J. Chem. Phys. 23 (1955) 518 (with P. Chang).
2. *Thermodynamic properties of ideal gaseous methanol*, J. Chem. Phys. 23 (1955) 1814 (with E.V. Ivash and K.S. Pitzer).
3. *Energy levels and thermodynamic functions for molecules with internal rotation. 4. Extended tables for molecules with small moments of inertia*, J. Chem. Phys. 60 (1956) 466 (with K.S. Pitzer).
4. *Thermodynamics for nonisothermal systems—classical formulation*, J. Chem. Phys. 29 (1958) 747.
5. *Cracks due to the piling-up of dislocations on 2 intersecting slip planes in MgO crystals*, Acta Metall. 7 (1959) 694 (with A.S. Keh and Y.T. Chou).
6. *Some elastic properties of an edge dislocation wall*, Acta Metall. 8 (1960) 563.
7. *Some elastic properties of a screw dislocation wall*, J. Appl. Phys. 31 (1960) 1318 (with C.D. Needham).
8. *The interaction of parallel edge dislocations with a simple tilt dislocation wall*, Acta Metall. 8 (1960) 296.
9. *Thermodynamics for nonequilibrium systems—principle of macroscopic separability and thermokinetic potential*, J. Appl. Phys. 33 (1962) 616.
10. *Possibility of subgrain rotation during recrystallization*, J. Appl. Phys. 33 (1962) 2958.
11. *Petch relation and grain boundary sources*, Trans. Metall. Soc. AIME 227 (1963) 239.
12. *Dislocation mechanism of transient creep*, Acta Metall. 11 (1963) 1269.
13. *Stress field of dislocation segment*, Phil. Mag. 10 (1964) 1097.
14. *Thermodynamics of dislocation mobility and 3rd-law analysis of activation process*, Trans. Metall. Soc. AIME 233 (1965) 219.
15. *Dislocation dynamics in deformation and recovery*, Can. J. Phys. 45 (1967) 493.
16. *Role of dislocations in flow stress grain size relationships*, Metall. Trans. 1 (1970) 1145 (with Y.T. Chou).
17. *Disclination loops in polymers*, J. Appl. Phys. 41 (1970) 4248 (with J.J. Gilman).
18. *Disclination model of high angle grain boundaries*, Surf. Sci. 31 (1971) 12.
19. *Dislocations in a welded interface between 2 isotropic media*, Mater. Sci. Eng. 10 (1972) 291 (with S. Nakahara and S. Wu).
20. *Impression creep—new creep test*, J. Mater. Sci. 12 (1977) 2200 (with S.N.G. Chu).
21. *Impression creep of LiF single crystals*, Phil. Mag. 36 (1977) 811 (with E.C. Yu).
22. *Impression creep of beta-tin single crystals*, Mater. Sci. Eng. 39 (1979) 1 (with S.N.G. Chu).
23. *Time-resolved laser-induced phase transformation in aluminum*, Phys. Rev. Lett. 52 (1984) 2364 (with S. Williamson and G. Mourou).
24. *Methanol transport in PMMA: the effect of mechanical deformation*, J. Polym. Sci., Part A 25 (1987) 3215 (with J.P. Harmon and S. Lee).
25. *Edge dislocations emitted along inclined planes from a mode-I crack*, Mater. Sci. Eng. A 104 (1988) 95 (with V. Lakshmanan).

Perhaps the most important legacy of Professor Li has been the outstanding cohort of scholars that he has successfully guided throughout his long career. This symposium marks the celebration of Professor Li's 80th birthday, which brought together many of his long standing colleagues and associates, all internationally well-known materials researchers, and provides a forum for exploring advances in the mechanical behavior of materials at both the micro- and nano-scales based on his founding formalism and theories.

Professor James C.M. Li has been the Hopeman Professor of Engineering at the University of Rochester for nearly 35 years. Before that he was at the Materials Research Lab at Allied Chemical Corporation where he did pioneering work on metallic glasses, especially for transformers. Still earlier he had spent 12 years at the U.S. Steel Research Lab. It was there that he started his brilliant career in the field of mechanical behavior of materials, nearly 50 years ago.

The symposium was organized under the co-sponsorship of TMS and ASM Mechanical Behavior of Materials Committee, Taiwan Information Storage Association and Association of Industries in Science Parks, and financially supported by the Asian Research Office of US Army International Technology Center, Taiwan Information Storage Association and Association of Industries in Science Parks, Hysitron Inc., and TMS-SMD. It consisted of 3.5 days of presentations covering eight subject areas: (1) Dislocation Mechanics of Plasticity, (2) Impression and Indentation Testing, (3) Diffusion and Atomistic Modeling, (4) Microstructure and System Stability, (5) Mechanics of Nanostructures, (6) Fatigue, Fracture and Failure, (7) Thin Films and Multilayers, and (8) Shock Compression.

The editors would like to thank all the speakers, and the session chairpersons for their contributions to the success of this special symposium. We also gratefully acknowledge the authors for their efforts to provide the manuscripts. The efforts of the reviewers are also greatly appreciated.

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