as continuous fibers. Obviously the interface in these systems has higher compatibility than in polymer-based composites. Interesting results have been observed in systems such as Al_2Cu, Al_2CuMg, Al_4Ca, or Al_3Ni in an aluminum matrix. Ni matrix composites have also been studied using Nb_3Al or Ni_3Nb as the fiber-reinforcing IMC.

High-Damping Alloys

Damping is the ability of a material to rapidly dissipate vibrational energy. Unlike polymers that can exhibit high damping in a particular frequency regime, damping in high-damping alloys is independent of frequency but is usually a function of stress amplitude. The damping mechanisms that are responsible for the internal friction that causes the decay in vibration include twin boundary motion, hysteresis in phase change, ferromagnetic and antiferromagnetic domain wall motion, order-disorder domain boundary motion, and interphase coherent boundary motion. An alloy long employed for vibration control in steam turbines is Nivco-10, a Co-Ni-based alloy with Al, Ti, and Zr. The precipitated phase responsible for the damping is $(Co,Ni)_3(TiZr,Al)$. Notable among the high-damping alloys, Nivco retains its damping at high temperatures. Alloys such as the NiTi SMA exhibit very high damping in the martensitic condition but no significant damping when in the austenitic (parent-phase) condition.[18] In addition the Young's modulus of these alloys is very low in their high-damping mode, and as such, they cannot be readily used as structural materials. Recent studies on the control of structural vibration during a seismic event have shown that SMAs can be used for ground isolation of the building. In this case, damping is due to the formation and recovery of SIM. Damping is particularly important in space structures since there is no effective damping due to air motion and the structures themselves tend to be large and flexible. Both passive damping using high-damping alloys and active damping using shape memory and piezoelectric actuators are being explored for this application. The demands of quality control under the new ISO 9000 standards have also increased the interest in high-damping alloys to control vibration-induced inaccuracies in machine tools.

There are many applications other than those discussed here that depend on the properties of IMCs, some in surprising systems and devices. The examples given describe some of the less familiar applications for these versatile materials.

References

1. H. Funakubo, ed., *Shape Memory Alloys* (Gordon and Breach, New York, 1987).
2. T. Duerig, K. Melton, D. Stoeckel, and C.M. Wayman, eds., *Engineering Aspects of Shape Memory Alloys* (Butterworth Heinemann, London).
3. R. Hultgren and L. Tarnopol, *Trans. Metall. Soc.* **133** (AIME) p. 228.
4. G. Gafner, *Gold Bull.* **22** (4) (1989) p. 112.
5. M.L.V. Gayler, *J. Inst. Met.* **60** (1937) p. 379.
6. National Institutes of Health (NIH) Technology Assessment Conference Statement (1991), *Effects and Side Effects of Dental Restorative Materials*, available from Office of Medical Applications of Research, NIH, Betheseda, MD 20892.
7. I. Babbitt, U.S. Patent No. 1252 (1989).
8. P.J. Macken and A.A. Smith, *The Aluminum Bronzes* (monograph, Copper Development Association, UK, 1966).
9. W.A. Glaeser, *Reactor Technol.* **15** (1) (1972).
10. H.P. Kattelus and H.A. Nicolet, in *Diffusion Phenomena in Thin Films and Microelectronic Materials*, edited by D. Gupta and P.S. Ho (Noyes Publications, Park Ridge, New Jersey) p. 432.
11. K.N. Tu and R. Rosenberg, *Thin Solid Films* **13** (1972) p. 163.
12. F.M. d'Heurle and R. Ghez, *Thin Solid Films* **215** (1992) p. 19.
13. D. Mondieig, Y. Haget, M. Labrador, M.A. Cuevas-Diarte, P.R. Van der Linde, and H.A.J. Oonk, *Mater. Res. Bull.* **26** (1991) p. 1091.
14. D. Farkas and C.E. Birchenall, *Metall. Trans.* **16A** (1985) p. 323.
15. D.E. Lacy C. Coles-Hamilton, and A. Juhasz, in *Proc. 22nd Intersociety Energy Conversion Engineering Conference*, vol. 1 (1987) p. 169.
16. R.C. Birtcher, C.W. Allen, L.E. Rehn, and G.L. Hofmann, *J. Nucl. Mater.* **152** (1988) p. 72.
17. T. Konishi, unpublished manuscript.
18. I.B. Kekalo, in *Encyclopedia of Materials Science and Engineering*, edited by M.B. Bever (Pergamon Press, Oxford, 1986) p. 2127. □

Advertisers in This Issue

	Page No.
Advanced Energy Industries, Inc.	6
Current Science Group	57
High Voltage Engineering	inside front cover
Hitachi Scientific Instruments	5
Huntington Laboratories	outside back cover
MDC Vacuum Products Corp.	3
Microscopy Courses	55
New Focus, Inc.	inside back cover
Philips Electronic Optics	11
Quesant Instruments Corp.	12
RJ Lee Instrument Ltd.	27
VAT	14
Virginia Semiconductor, Inc.	28
Voltaix, Inc.	23

For free information about the products and services offered in this issue, fill out and mail the Reader Service Card, or FAX it to (312) 922-3165.