

8. ACKNOWLEDGMENTS

This research was performed in part in the NIST Center for Nanoscale Science and Technology Nano Fabrication Clean Room. This work was supported by the Measurement Science for Intelligent Manufacturing Robotics and Automation Program of the Intelligent System Division, Engineering Laboratory, National Institute of Standards and Technology, USA.

9. REFERENCES

- [1] Du E, Cui H and Zhu Z 2006 Review of nanomanipulators for nanomanufacturing Int. J. Nanomanufacturing 1 (1) 83-104
- [2] W. P. Sassen, V.A. Henneken, M. Tichem, P. M. Sarro, "An improved in-plane thermal folded V-beam actuator for optical fibre alignment," J. Micromech. Microeng. 18 (2008) 075033
- [3] S. Kwon and L. P. Lee, "Stacked two dimensional micro-lens scanner for micro confocal imaging array," Proc. Fifteenth IEEE International Conference on Micro Electro Mechanical Systems, Las Vegas, NV, USA 20-24 Jan. 2002, pp. 483-486, 2002
- [4] Toshiyoshi H, Su G J, LaCosse J and Wu M C 2003 "A surface micromachined optical scanner array using photoresist lenses fabricated by athermal reflow process" J. Lightwave Technol. 21 1700-8
- [5] Kim, K., Liu, X., Zhang, Y., and Sun, Y., 2008, "Nanonewton Force-Controlled Manipulation of Biological Cells Using a Monolithic MEMS Microgripper With Two-Axis Force Feedback," J. Micromech. Microeng., 18 5 ,p. 055013.
- [6] Kim C. H., Jeong H M, Jeon J U and Kim Y K 2003 Silicon micro XY-stage with a large area shuttle and no-etching holes for SPM-based data storage J. Microelectromech. Syst. 12 470-8
- [7] B. Sahu, C. R. Taylor "Emerging Challenges of Microactuators for Nanoscale Positioning, Assembly, and Manipulation," J. of Manufacturing Science and Engineering, June 2010, vol. 132/030917-1
- [8] Bell, D. J., Lu, T. J., Fleck, N. A., and Spearing, S. M., 2005, "MEMS Actuators and Sensors: Observations on Their Performance and Selection for Purpose," J. Micromech. Microeng., 15(7), pp. S153-S164.
- [9] J. H. Comtois and V. M. Bright, "Surface micromachined polysilicon thermal actuator arrays and applications," in Proc. Tech. Dig. Solid-State Sens. Actuators Workshop, Hilton Head Island, SC, Jun. 2-6, 1996, pp. 174-176
- [10] W. C. Chen, P. I. Yeh, C. F. Hu and W. Fang, "Design and Characterization of Single-Layer Step-Bridge Structure for Out-of-Plane Thermal Actuator," J. of MEMS, Vol. 17, No. 1, Feb. 2008, p70 – p77
- [11] M. McCarthy, N. Tiliakos, V. Modi, L. G. Frechette, "Thermal buckling of eccentric microfabricated nickel beams as temperature regulated nonlinear actuators for flow control," Sensors and Actuators A: Physical Volume 134, Issue 1, 28 February 2007, Pages 37-46 International Mechanical Engineering congress and Exposition 2005
- [12] J. H. Comtois, V.M. Bright, "Applications for surface-micromachined polysilicon thermal actuators and arrays," Sensor and Actuators A 58, 1997, p19-25
- [13] D. M. Burn, V. M. Bright, "Design and performance of a double hot arm polysilicon thermal actuator," proc. Of the SPIE micromachining and microfabrication conference, Austin, TX, Sep. 1997, pp.296-306
- [14] F. P. Beer and E. R. Johnston, Jr, "Mechanics of Materials," 2nd edition, McGrawHill, 1992, pp 650 - 653
- [15] [Kim YS, Nicholas NG, Gupta SK 2011 A Two Degree of Freedom Nanopositioner with Electrothermal Actuator for Decoupled Motion, ASME/IDETC conference, DC, USA