11. Publications & Patents

IRG 1

McGuiness, C. L.; Shaporenko, A.; Mars, C. K.; Uppili, S.; Zharnikov, M., **Allara, D. L.** Molecular self-assembly at bare semiconductor surfaces: Preparation and characterization of highly organized octadecanethiolate monolayers on GaAs(001). *Journal of the American Chemical Society* **2006,** *128,* 5231-5243. [Partial support.]

Daniel T. A., Uppili S., McCarty, G., and **Allara, D. L**. Effects of molecular structure and interfacial ligation on the precision of cu-bound α, – mercaptoalkanoic acid "molecular ruler stacks", Langmuir, in press. [Primary support]

Daniel, T.; McCarty, G.; **Allara, D.** How precise are self-assembled "molecular ruler" stack films? Molecular structure and interfacial ligation in Cu bound alkanethiolcarboxylic acid stacks. *Langmuir* **2007,** *23,* 638-648. [Partial support.]

Dixon, M. C.; Daniel, T. A.; Hieda, M.; Smilgies, D. M.; **Chan, M. H. W.; Allara, D. L.** Preparation, structure and optical properties of nanoporous gold thin films. *Langmuir* **in press**. [Partial support.]

McGuiness, C. L.; Shaporenko, A.; Zharnikov, M.; Walker, A. V.; **Allara, D. L.** Molecular self assembly at bare semiconductor surfaces: Investigation of the chemical and electronic properties of the alkanethiolate-GaAs(001) interface. Accepted for Publication in *Journal of Physical Chemistry C.* [Partial support.]

Anderson, M. E., Tan, L. P., Mihok, M., Tanaka, H., **Horn, M. W**., McCarty, G. S., **Weiss, P. S**. "Photolithographic structures with precise controllable nanometer-scale spacings created by molecular rulers", *Advanced Materials* **2006**, *18*, 1020 [Primary support]

Srinivasan C., Anderson, M. E., Carter, E. M., Hohman, J. N., Bharadwaja, S. S. N., **Trolier-McKinstry, S., Weiss, P. S. and Horn, M. W.,** "Extensions of molecular ruler technology for nanoscale patterning, *Journal of Vacuum Science and Technology B* **2006** 24, 3200 [Primary support]

Srinivasan C. Anderson, M. E., Jayaraman, R., **Weiss, P. S**. and **Horn, M. W**., "Electrically isolated nanostructures fabricated using self-assembled multilayers and a novel negative-tone bi-layer resist stack", *Microelectronic Engineering* **2006** 83, 1517 [Primary support]

Srinivasan, C., Hohman, J. N., Anderson, M. E., **Weiss, P. S.**, and **Horn, M. W.,** "Molecular resist for sub-30 nm patterning", *Proceedings of the SPIE*, **2007**

Mullen, T. J.; Hohman, J. N.; Dameron, A. A.; Hampton, J. R.; Gillmor, S. D.; **Weiss, P. S.** Displaceable monolayers and microdisplacement printing: 1-adamantanethiol assembly and application. *Materials Matters* **2006,** *1* (2), 8. [Primary support.]

Hampton, J. R.; Dameron, A. A.; **Weiss, P. S.** Double ink dip-pen nanolithography to elucidate molecular transport. *Journal of American Chemical Society* **2006,** *128,* 1648. [Primary support.]

Mullen, T. J.; Dameron, A. A.; **Weiss, P. S.** Directed assembly and separation of self-assembled monolayers via electrochemical processing. *Journal of Physical Chemistry B* **2006,** *110,* 14410. [Primary support.]

Smith, R. K.; Nanayakkara, S. U.; Woehrle, G. H.; Pearl, T. P.; Blake, M. M.; Hutchison, J. E.; **Weiss, P. S.** Spectral diffusion in the tunneling spectra of chemically precise ligand-stabilized undecagold clusters. *Journal of the American Chemical Society* **2006,** *128,* 9266. [Primary support.]

Anderson, M. E.; Srinivasan, C.; Hohman, J. N.; Carter, E. M.; **Horn, M. W.; Weiss, P. S.** Combining conventional lithography with molecular self-assembly for chemical patterning. *Advanced Materials* **2006,** *18,* 3258. [Primary support.]

Fuchs, D. J.; **Weiss, P. S.** Insertion of 1,10-decanedithiol in decanethiolate self-assembled monolayers on Au{111}. *Nanotechnology* **2007,** *18,* 044021. [Primary support.]

Mullen, T. J.; Dameron, A. A.; **Andrews, A. M.; Weiss, P. S.** Selecting and driving nanoscale assembly in monolayer films through tailored intermolecular interactions. *Aldrichimica Acta* **2007,** *40,* 21. [Primary support.]

Mullen, T. J.; Srinivasan, C.; Hohman, J. N.; Gillmor, S. D.; Shuster, M. J.; **Horn, M. W.; Andrews, A. M.; Weiss, P. S.** Microcontact insertion printing. *Applied Physics Letters* **2007,** *90,* 063114. [Primary support.]

Mullen, T. J.; Dameron, A. A.; Saavedra, H. M.; Lammert, P.; **Crespi, V. H.; Weiss, P. S.** Dynamics of 1-adamantanethiolate displacement. *Journal of Physical Chemistry C* **in press.** [Primary support.]

Dameron, A. A.; Mullen, T. J.; Hengstebeck, R. W.; Saavedra, H. M.; **Williams, M. E.; Weiss, P. S.** Origins of 1-adamantanethiolate displacement. *Journal of Physical Chemistry C* **in press.** [Primary support.]

Srinivasan, C.; Hohman, J. N.; Anderson, M. E.; Zhang, P. P.; **Weiss, P. S.; Horn, M. W.** Molecular-ruler nanolithography. *Proceedings of the SPIE* **in press.** [Primary support.]

Kim, S. -K.; Lee, H.; Tanaka, H.; **Weiss, P. S.** Vertically aligned single-walled carbon nanotube film formed by electrodeposition. Manuscript Submitted for Publication. [Partial support.]

Shuster, M. J.; Mullen, T. J.; Vaish, A.; Hohman, J. N.; Gillmor, S. D.; **Weiss, P. S.; Andrews, A. M.** Patterning of optimally diluted biospecific small molecule probe surfaces. Manuscript Submitted for Publication. [Primary support.]

Saavedra, H. M.; Barbu, C. M.; Dameron, A. A.; Mullen, T. J.; **Crespi, V. H.; Weiss, P. S.** Kinetics and mechanism of 1-adamantanethiolate displacement. Manuscript to be Submitted for Publication. [Primary support.]

Mullen, T. J.; Srinivasan, C.; Shuster, M. J.; **Weiss, P. S.** Hybrid approaches to nanometer-scale patterning exploiting tailored intermolecular interactions. Manuscript in Preparation. [Primary support.]

Badalmenti, J. P.; Weiss, L. E.; Buckno, C. J.; Richard, T. L.; **Weiss, P. S.;** Cirino, P. C. Synthetic sports: A bacterial relay race. *IET Synthetic Biology* **2007.**

Takami, T., Arnold, D. P., Ruchs, A. V., Will, G. D., Goh, R. Waclawik, E. R., Bell, J. M., **Weiss, P. S.**, Sugiura, Liu, W. and Jiang, J., "Two-dimensional crystal growth and stacking of bis- and tris-phthalocyaninato rare earth sandwich complexes at the 1-phenyloctane/graphite interface", *Journal of Physical Chemistry B*, **2006** 110, 1661 [Primary support]

Ye, T., Takami, T.,. Wang, R., Jiang, J., and **Weiss, P. S.**, "Tuning interactions between ligands in self-assembled double-decker phthalocyanine arrays", *Journal of the American Chemical Society*, 2006, **128**, 10984 [Primary support]

Takami, T., Ye, T., Arnold, D. P., Sugiura, K. I., Jiang, J., and **Weiss, P. S.**, "Controlled adsorption orientation for double-decker complexes", *Journal of Physical Chemistry C* **2006** ASAP, in print **2007** [Primary support]

IRG 2

Subramanian, S.; **Catchmark, J. M.** Molecular ruler lithography with sacrificial multilayer host structure patterned using electron beam lithography. *Journal of Microlithography, Microfabrication and Microsystems* **2006,** *5* (4), 049701. [Partial support.]

Subramanian, S.; **Catchmark, J. M.** Molecular ruler lithography processes and their application to sub 50nm MOS devices. *ACS March 2006 in Polymers for Enabling Nanoscale Patterning Division.* [Partial support.]

Subramanian, S.; **Catchmark, J. M.** Control of catalytically generated electroosmotic fluid flow through surface zeta potential engineering. Manuscript Submitted for Publication. [Partial support.]

Verma, V.; **Hancock, W. O.; Catchmark, J. M.** Nanoscale patterning of kinesin motor proteins and its role in guiding microtubule motility. Manuscript Submitted for Publication. [Primary support.]

Verma, V., **Hancock W. O., Catchmark, J. M.,** "*Electron beam patterned kinesin motors guide microtubule motility*", submitted to *Small* **2006** [Partial support]

Uppalapati, M., Huang, Y. –M., **Jackson, T. N., Hancock, W. O.**, Alignment and manipulation of microtubles by AC electric fields", submitted *Biophyscial Journal* **2006** [Primary support]

Hutchins, B. M.; **Hancock, W. O.; Williams, M. E.** Magnet assisted fabrication of microtubule arrays. *Physical Chemistry Chemical Physics* **2006,** *8,* 3507-3509. [Primary support.]

Muthukrishnan, G.; Hutchins, B. M.; **Williams, M. E.; Hancock, W. O.** Transport of semiconductor nanocrystals by kinesin molecular motors. *Small* **2006,** *2* (5), 626-630. [Primary support.]

Hutchins, B. M.; **Hancock, W. O.; Williams, M. E.** Motility of $CoFe_2O_4$ nanoparticle-labelled microtubules in magnetic fields. *Micro and Nano Letters* **2006,** *1* (1), 47-52. [Primary support.]

Hutchins, B. M.; Platt, M.; **Hancock, W. O.; Williams, M. E.** Directing transport of $CoFe_2O_4$-functionalized microtubules with magnetic fields. *Small* **2007,** *3* (1), 126-131. [Primary support.]

Huang, Y. M.; Uppalapati, M.; **Hancock, W. O.; Jackson, T. N.** Microtubule transport, concentration and alignment in enclosed microfluidic channels. *Biomedical Microdevices* ***in press.*** [Partial support.]

Paxton, W. F.; Baker, P. T.; Kline, T. R.; Wang, Y.; **Mallouk, T. E.; Sen, A.** Catalytically induced electrokinetics for nanomotors and nanopumps. *Journal of the American Chemical Society* **2006,** *128,* 14881-14888. [Primary support.]

Wang, Y.; Hernandez, R. M.; Bartlett, Jr., D. J.; Bingham, J. M.; Kline, T. R.; **Sen, A.; Mallouk, T. E.** A bipolar electrochemical mechanism for propulsion of catalytic nanomotors in hydrogen peroxide solutions. *Langmuir* **2006,** *22,* 10451-10456. [Primary support.]

Paxton, W. F.; Sundarajan, S.; **Mallouk, T. E.; Sen, A.** Chemical locomotion. *Angew. Chem.* **2006,** *33,* 5546-5556. [Primary support.]

Segawa, H.; Abrams, N.; **Mallouk, T. E.;** Divliansky, I.; **Mayer, T. S.** Fabrication of TiO2-organic hybrid dot arrays using laser interference holography. *Journal of the American Ceramic Society* **2006,** *89,* 3507-3510. [Primary support.]

Khoo, I. C.; Williams, Y. L.; Lewis, B.; **Mallouk, T. E.** +-Photorefractive CdSe and gold nanowire-doped liquid crystals and polymer-dispersed-liquid-crystal photonic crystals. *Molecular Crystals and Liquid Crystals* **2006,** *446,* 233-244. [Primary support.]

Kline, T. R.; Tian, M.; Wang, J.; **Sen, A.; Chan, M. W. H.; Mallouk, T. E.** Template grown metal nanowires. *Inorganic Chemistry* **2006,** *45,* 7555-7565. [Primary support.]

Dhar, P.; Fischer, T. M.; Wang, Y.; **Mallouk, T. E.;** Paxton, W. F.; **Sen, A.** Autonomously moving nanorods at a viscous interface. *Nano Letters* **2006,** *6,* 66-72. [Primary support.]

Dhar, P.; Cao, Y.; Kline, T.; Pal, P.; Swayne, C.; Fischer, T. M.; Miller, B.; **Mallouk, T. E.; Sen, A.;** Johansen, T. H. Autonomously moving local nanoprobes in heterogeneous magnetic fields. *Journal of Physical Chemistry C* **2007**.

Kline, T. R.; Paxton, W. F.; **Mallouk, T. E.; Sen, A.** Developing catalytic nanomotors. *Nanotechnology in Catalysis* **2007,** 23.

Shira, Y.; Morin, J. -F.; Sasaki, T.; Guerrero, J.; **Tour, J. M**. Recent progress on nanovehicles. *Chemical Society Reviews* **2006,** *35,* 1043-1055. [Partial support.]

Morin, J. -F.; Shirai, Y.; **Tour, J. M**. En route to a motorized nanocar. *Organic Letters* **2006,** *8*, 1713-1716. [Primary support.]

Shirai, Y.; Osgood, A. J.; Zhao, Y.; Yao, Y.; Saudan, L.; Yang, H.; Yu-Hung, C.; Alemany, L. B.; Sasaki, T.; Morin, J. -F.; Guerrero, J.; Kelly, K. F.; **Tour, J. M.** Surface-rolling molecules. *Journal of the American Chemical Society* **2006,** *128,* 4854-4864. [Partial support.]

Kline, T. R.; Iwata, J.; Lammert, P. E.; **Mallouk, T. E.; Sen, A.; Velegol, D.** Catalytically-driven colloidal patterning and transport. *Journal of Physical Chemistry B* **2006,** *110,* 24513-24521. [Primary support.]

Paxton, W. F.; Kline, T. R.; Wang, Y.; Lammert, P. E.; **Crespi, V. H.; Velegol, D.; Mallouk, T. E.** Catalytic motors and pumps on the nano- and microscale. *Abstracts of Papers of the American Chemical Society* **2006,** *231*. [Partial support.]

Takami, T.; Ye, T.; Arnold, D. P.; Sugiura, K. -I.; Wang, R.; Jiang, J.; **Weiss, P. S.** Controlled adsorption orientation of double-decker complexes. *Journal of Physical Chemistry C* **2007,** *111,* 2077. [Primary support.]

Hutchins, B. M.; Morgan, T. T.; **Williams, M. E.** Optical properties of fluorescent mixtures: Comparing quantum dots to laser dyes. *Journal of Chemical Education* ***in press*****.** [Primary support.]

Hutchins, B. M.; Platt, M.; **Hancock, W. O.;** & **Williams, M. E.** Directing transport of magnetically labeled microtubules. *Small* **2007,** *3,* 126-131. [Primary support.]

IRG 3

Kurtz, J. S.; Johnson, R. R.; Tian, M. L.; Kumar, N.; Ma, Z.; Xu, S. Y.; **Chan, M. H. W.** Specific heat of superconducting Zn nanowires. Manuscript Submitted for Publication. [Primary support.]

Tian, M. L.; Wang, J.; Kumar, N.; Han, T.; Kobayashi, Y.; Liu, Y.; **Mallouk, T. E.; Chan, M. H. W.** Observation of superconductivity in granular bi nanowires fabricated by electrodeposition. *Nano Letters* **2006,** *6,* 2773. [Primary support.]

Tian, M. L.; Kumar, N.; Wang, J. G.; Xu, S. Y.; **Chan, M. H. W.** Influence of a bulk superconducting environment on the superconductivity of one-dimensional zinc nanowires. *Physical Review B* **2006,** *74,* 014515. [Primary support.]

Tian, M. L.; Kumar, N.; Xu, S. Y.; Wang, J. G.; Kurtz, J. S.; **Chan, M. H. W.** Suppression of superconductivity in zinc nanowires by bulk indium superconductors. *Physics* **2006,** *(in Chinese), 35* (7), 556. [Primary support.]

Kim, H.; Lim, J.; Choi, K.; Kenny, D.; **Jackson, T. N.** Frame enclosed resonator for miniaturized OCXO. *Transactions 2006 IEEE International Frequency Control Symposium* **2006,** 491-493. [Partial support.]

Lim, J.; Kim, H.; Choi, K.; **Jackson, T. N.;** Kenny, D. Miniature oven controlled crystal oscillator (OCXO) on a CMOS frame. *Transactions 2006 IEEE International Frequency Control Symposium* **2006,** 401-404. [Partial support.]

Fry, R. A.; Kwon, K. D.; **Komarneni, S.;** Kubicki, J. D.; Mueller, K. T. A solid-state NMR and computational chemistry study of mononucleotides adsorbed to alumina. *Langmuir* **2006,** *22,* 9281-9286. [Partial support.]

Gao, F.; Lu, Q.; **Komarneni, S.** Fast synthesis of cerium oxide nanoparticles and nanorods. *Journal of Nanoscience and Nanotechnology* **2006,** *6,* 3812-3819. [Primary support.]

Gao, F.; Lu, Q. Y.; **Komarneni, S.** Gluconate controls one-dimensional growth of tellurium nanostructures. *Journal of Materials Research* **2006,** *21,* 343-348. [Partial support.]

Lu, Q. Y.; Gao, F.; **Komarneni, S.** Cellulose-directed growth of selenium nanobelts in solution. *Chemistry of Materials* **2006,** *18,* 159-163. [Partial support.]

Lu, Q. Y.; Gao, F.; **Komarneni, S.** Multi-level assemblies of lead sulphide nanorods. *Nanotechnology* **2006,** *17,* 2574-2580. [Primary support.]

Shir, D.; Liu, B. Z.; Mohammad, A. M.; Lew, K. K.; **Mohney, S. E.** Oxidation of silicon nanowires. *Journal of Vacuum Science & Technology B* **2006,** *24,* 1333-1336. [Partial support.]

Liu, B.; Wang, Y.; Dilts, S.; **Mayer, T. S.; Mohney, S. E.** Silicidation of Silicon Nanowires by Platinum. *Nano Letters* **in press.** [Partial support.]

Lew, K. K.; Pan, L.; **Dickey, E. C.; Redwing, J. M.** Effect of growth conditions on the composition and structure of $Si_{1-x}Ge_x$ nanowires grown by vapor-liquid-solid growth. *Journal of Materials Research* **2006,** *21,* 2876-2881. [Partial support.]

Bharadwaja, S. S. N.; Olszta, M.; **Dickey, E. C.; Trolier-McKinstry, S.;** Li, X.; **Mayer, T. S.;** Roozeboom, F. Fabrication of high aspect ratio ferroelectric microtube structures using a vacuum infiltration technique. *Journal of the American Ceramic Society* **2006,** *89,* 2695-2701. [Primary support.]

Gharb, N. B.; **Trolier-McKinstry, S.;** Damjanovic, D. Piezoelectric nonlinearity in ferroelectric thin films. *Journal of Applied Physics* **2006,** *100,* 0441007. [Partial support.]

Srinivasan, C.; Anderson, M. E.; Carter, E. M.; Hohmann, J. N.; Bharadwaja, S. S. N.; **Trolier-McKinstry, S.; Weiss, P. S.; Horn, M. W.** Extensions of molecular ruler technology for nanoscale patterning. *Journal of Vacuum Science and Technology B* **2006,** *24 (6),* 3200-3204. [Primary support.]

Telli, M. B.; Bharadwaja, S. S. N.; Biegalski, M. D.; **Trolier-McKinstry, S.** (00*l*) Epitaxial $AgTaO_3$ and $AgNbO_3$ thin films on (001)$SrRuO_3$/(001)$LaAlO_3$ substrates by chemical solution deposition. *Applied Physics Letters* **2006,** *89,* 252907. [Partial support.]

Trolier-McKinstry, S.; Gharb, N. B.; Damjanovic, D. Piezoelectric nonlinearity due to motion of 180 degrees domain walls in ferroelectric materials at subcoercive fields: A dynamic poling model. *Applied Physics Letters* **2006,** *88,* 202901. [Partial support.]

Vaughan, D. E. W.; Yennawar, H. P.; Perrotta, A. J. Synthesis and structure of an aluminophosphate built from 3-rings. *Chemistry of Materials* **2006,** *18,* 3611-3615. [Partial support.]

Vaughan, D. E. W.; Yennawar, H. P.; Perrotta, A. J. Synthesis and structure of large optically clear crystals of gallogermanate sodalite. *Crystal Growth & Design* **2006,** *6,* 2072-2075. [Partial support.]

Yates, T. J. V.; Ward, E. P. W.; Fernandez, J. -J.; **Vaughan, D. E. W;** Midgley, P. A. Three-dimensional nanoscale tomographic analysis of the porosity, loading and fractal nature of disordered mesoporous silica catalysts. Manuscript Submitted for Publication. [Partial support.]

IRG 4

Sazio, P. J. A.; Amezcua-Correa, A.; Finlayson, C. E.; Hayes, J. R.; Scheidemantel, T. J.; Baril, N. F.; Jackson, B. R.; Won, D. J.; Zhang, F.; Margine, E. R.; **Gopalan, V.; Crespi, V. H.; Badding, J. V.** Microstructured optical fibers as high-pressure microfluidic reactors. *Science* **2006,** *311,* 1583-1586. [Partial support.]

Badding, J. V.; Gopalan, V.; Sazio, P. J. A. Building semiconductor structures in optical fiber. *Photonics Spectra* **2006,** *40,* 80-88. [Partial support.]

Baril, N. F.; **Badding, J. V.; Gopalan, V.;** Sazio, P. J. A.; Scheidemantel, T. J.; Jackson, B. R.; Won, D. -J.; Amezcua-Correa, A.; Finlayson, C. Microstructured optical fibers as new nanotemplates for high pressure CVD. *Materials Research Society Symposium Proceedings.* Accepted for Publication. [Partial support].

Finlayson, C. E.; Amezcua-Correa, A.; Sazio, P. J. A.; Baril, N. F.; **Badding, J. V.** Electrical and raman characterization of silicon- and germanium-filled microstructured optical fibers. Accepted for Publication in *Applied Physics Letters.* [Partial support.]

Badding, J. V.; Sazio, P. J. A.; **Gopalan, V.;**Amezcua-Correa, A.; Scheidemantel, T. J.; Finlayson, C. E.; Baril, N. F.; Jackson, B. R.; Wong, D. Integrated optoelectronics in an optical fiber. *Proceedings of SPIE – The International Society for Optical Engineering* **in press.** [Partial support.]

Margine, E. R., & **Crespi, V. H.** (2006). Universal behavior of nearly free electron states in carbon nanotubes. *Physical Review Letters, 96*. [Partial support.]

Wang, R. F.; Nisoli, C.; Freitas, R. S.; Li, J.; McConville, W.; Cooley, B. J.; Lund, M. S.; Samarth, N.; Leighton, C.; **Crespi, V. H.; Schiffer, P.** Artificial 'spin ice' in a geometrically frustrated lattice of nanoscale ferromagnetic islands. *Nature* **2006,** *439,* 303-306. [Partial support.]

Khoo, I. C.; Werner, D. H.; Liang, X.; Diaz, A.; Weiner, B. Nano-sphere dispersed liquid crystals for tunable negative-zero-positive index of refraction in the optical and terahertz regimes. *Optics Letters* **2006,** *31,* 2592-2594. [Primary support.]

Khoo, I. C.; Williams, Y.; Diaz, A.; Chen, K.; Bossard, J. A.; **Werner, D. H.;** Graugnard, E.; Summers, C. J. Liquid-crystals for optical filters, switches and tunable negative index material development. *Molecular Crystals and Liquid Crystals* **2006,** *453,* 309-319. [Primary support.]

Khoo, I. C.; Diaz, A.; Bossard, J. A.; **Werner, D. H.** Liquid crystal cladded metallo-dielectric and all-dielectric frequency selective surfaces for broadband tunable optical filters and planar negative index optics. *Proceedings of SPIE Conference on Liquid Crystals X* **2006.** [Primary support.]

Summers, C. J.; Graugnard, E.; Gaillot, D. P.; King, J. S.; Zhang-Williams, Y.; **Khoo, I. C.** Tunable 3D photonic crystals by liquid crystal infiltration. *Proceedings of SPIE Conference on Liquid Crystals X* **2006.** [Primary support.]

Khoo, I. C.; Diaz, A.; Bossard, J. A.; Liang, X.; **Werner, D. H.** Nano-dispersed liquid crystalline structures for tunable negative-, zero-, and positive index materials in the optical-terahertz regimes. *IEEE Proceeding on International Symposium on Bio-Photonics, Nano-Photonics and Metamaterials, Hangzhou, China, October 16-19,* **2006.** [Primary support.]

Bossard, J. A.; Li, L.; **Werner, D. H.; Khoo, I. C.** Infrared liquid crystal tunable frequency selective surfaces. *Proceedings of the 2006 IEEE Antennas and Propagation Society International Symposium with USNC/URSI National Radio Science and MEREM Meetings, Albuquerque, NM, pp. 4489-4492, July 9-14,* **2006.** [Primary support.]

Khoo, I. C.; Diaz, A. Nano-spheres dispersed liquid crystal supra-nonlinear negative-zero-positive index metamaterials. *Proceedings Vol. 6470 – Conference on Organic Photonic Materials and Devices IX- Photonic West 2007, San Jose, CA, January,* **2007.** *[Primary support.]*

Khoo, I. C.; Chen, K.; Williams, Y. Z. Orientational photorefractive effect in undoped and CdSe nano-rods doped nematic liquid crystal bulk and interface contributions. *IEEE Journal of Selected Topics in Quantum Electronics* **2006,** *12* (3), 443-450. [Primary support.]

Bossard, J. A.; **Werner, D. H.; Mayer, T. S.;** Smith, J. A.; Tang, Y. U.; Drupp, R. P.; Li, L. The design and fabrication of planar multiband metallodielectric frequency selective surfaces for infrared applications. *IEEE Transactions on Antennas and Propagation* **2006,** *54,* 1265-1276. [Primary support.]

Li, L.; **Werner, D. H.;** Bossard, J. A.; **Mayer, T. S.** A model-based parameter estimation technique for wide-band interpolation of periodic moment method impedance matrices with application to genetic algorithm optimization of frequency selective surfaces. *IEEE Transactions on Antennas and Propagation* **2006,** *54,* 908-924. [Primary support.]

Khoo, **I. C.; Werner, D. H.;** Diaz, A. Nano-dispersed liquid crystal with tunable negative-zero-positive refractive indices. *Optics and Photonics News* **2006,** *17*(12), 33. [Primary support.]

Kwon, D. -H.; **Werner, D. H.;** Kildishev, A. V.; Shalaev, V. M. Near-infrared metamaterials with dual-band negative-index characteristics. Accepted for publication in *Optics Express* **2007,** *15* (3). [Primary support.]

Kwon, D. -H.; Bossard, J. A.; Li, L.; Bray, M. G.; **Werner, D. H.** Zero-index metamaterial utilizing drude-type material blocks arranged in a checkerboard pattern. Manuscript Submitted for Publication. [Primary support.]

Kildishev, A. V.; Chettiar, U. K.; Liu, Z.; Kwon, D. -H.; Bayraktar, Z.; **Werner, D. H.;** Shalaev, V. M. Stochastic optimization of low-loss optical negative index metamaterial. Manuscript Submitted for Publication. [Partial support.]

Liang, X.; **Werner, D. H.;** Weiner, B. A novel concept for reconfigurable frequency selective surfaces based on silicon switches. Accepted for Publication in *Microwave and Optical Technology Letters* **2007.** [Primary support.]

Bossard, J. A.; Liang, X.; Li, L.; **Werner, D. H.;** Weiner, B.; Cristman, P. F.; Diaz, A.; **Khoo, I. C.** Tunable frequency selective surfaces and negative-zero-positive index metamaterials based on liquid crystals. Manuscript Submitted for Publication. [Primary support.]

Werner, D. H.; Kwon, D. -H.; **Khoo, I. C.;** Kildishev, A. V.; Shalaev, V. M. Liquid crystal clad near-infrared metamaterials with tunable negative-zero-positive refractive indices. Manuscript Submitted for Publication. [Primary support.]

Kwon, D. -H.; **Werner, D. H.** Synthesis of low-index metamaterial slabs using genetic algorithms. Manuscript Submitted for Publication. [Primary support.]

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Cai, J.; & **Mahan, G. D.** Energy bands of quantum dot arrays. Manuscript Submitted for Publication. [Primary support.]

Yuan, M.; **Badding, J.; Sen, A.;** Dahlberg, M.; **Schiffer, P.** Controlled assembly of zero-, one-, two- and three-dimensional metal chalcogenide structures. Manuscript Submitted for Publication. [Primary support.]

Dirmyer, M.; Borker, S.; **Badding, J. V.; Sen, A.** Synthesis of Bismuth telluride nanostructures: Temperature and ligand effects. *Abstracts of Papers, 232nd ACS National Meeting, San Francisco, CA, September 10-14,* **2006.** [Primary support.]

Ren, Y. H.; Wang, D.; Adyam, V.; **Li, Q.;** Luepke, G.; Merlin, R. Femtosecond time-resolved optical and magneto-optical Kerr studies of coherent spin dynamics in La0.67Ca0.33MnO3. Manuscript Accepted for Publication in the *Journal of Applied Physics* **2006.** [Partial support.]

Ren, Y. H.; Lupke, G.; Hu, Y. F.; **Li, Q.;** Hong, C. S.; Hur, N. H.; Merlin, R. Anomalous first-to-zero sound crossover in $La_{1-x}Ca_xMnO_3$. *Physical Review B* **2006,** *74,* 012405. [Partial support.]

Talbayev, D.; Zhao, H.; Lupke, G.; Venimadhav, A.; **Li, Q.** Photoinduced coherent magnetization procession in epitaxial $La_{0.67}Ca_{0.33}MnO_3$ films. *Physical Review B* **2006,** *73,* 014417. [Partial support.]

Venimadhav, A.; Ma, Z.; **Li, Q.;** Soukiassian, A.; Xi, X. X.; **Schlom, D. G.;** Arroyave, R.; Liu, Z. K.; Lee, M.; & Ong, N. P. Thermoelectric properties of exptaxial and topotaxial Na_xCoO_2 thin films. *2005 MRS Fall Meeting Symposium Proceedings F **2006.*** [Partial support.]

Venimadhav, A.; Tenne, D. A.; **Li, Q.;** Wilson, M. J.; Schiffer, P.; Xi, X. X.; Lee, J. H.; **Schlom, D. G.** Influence of b-site cationic ordering on the magnetic properties of La_2NiMnO_6 epitaxial thin films. Manuscript Submitted for Publication. [Partial support.]

Fedkin, M. V.; Chalkova, E.; **Komarneni, S.;** Wesolowski, D. J.; **Lvov, S. N.** Surface electrochemistry of composite materials for high-temeprature PEM fuel cells. *ECS Transactions* **2006,** *1,* 215. [Partial support.]

Chalkova, E.; Rybka, G.; Fedkin, M. V.; Wesolowski, D. J.; Roelofs, M.; **Lvov, S. N.** Nafion/TiO2 composite membranes for PEM fuel cells operating at elevated temperature and reduced relative humidity. *ECS Transactions* **2006,** *3,* 73. [Primary support.]

Chung, M.; **Komarneni, S.;** Chalkova, E.; **Lvov, S. N.** Proton conductive composite materials with co-continuous phases using silane functionalized and crosslinkable PVDF polymers. *ECS Transactions* **2006,** *3,* 83. [Primary support.]

Chalkova, E.; Fedkin, M. V.; **Komarneni, S.; Lvov, S. N.** Nafion/Zirconium phosphate composite membranes for PEM fuel cells operating at temperature up to 120^{o}C and relative humidity down to 13%. *Journal of the Electrochemical Society* **in press.** [Primary support.]

Li, Y. L.; Hu, S.Y.; Tenne, D.; Xi, X. X.; **Schlom, D. G.;** Choi, K. J.; Eom, C. B.; Saxena, A.; Lookman, T.; Jia, Q. X.; Chen, L. Q. Breakdown of single-domain assumption for ferroelectric superlattices. Manuscript Submitted for Publication. [Primary support.]

Schlom, D. G.; Chen, L. Q.; Eom, C. B.; Rabe, K. M.; Streiffer, S. K.; Triscone, J. -M. Strain tuning of ferroelectric thin films. Manuscript Submitted for Publication. [Partial support.]

Zurbuchen, M. A.; Freitas, R. S.; Wilson, M. J.; **Schiffer, P.;** Roeckerath, M.; Schubert, J.; Mehta, G. H.; Comstock, D. J.; Lee, J. H.; Jia, Y.; **Schlom, D. G.** Synthesis and characterization of an $n = 6$ aurivillius phase incorporating magnetically active manganese, $Bi_7(Mn,Ti)_6O_{21}$. Manuscript Submitted for Publication. [Primary support.]

Venimadhav, A.; Tenne, D. A.; Wilson, M. J.; **Schiffer, P.; Li, Q.;** Lee, J. H.; **Schlom, D. G.;** Xi, X. X. Influence of b-site cationic ordering on the magnetic properties of La_2NiMnO_6 epitaxial thin films. Manuscript Submitted for Publication. [Primary support.]

Zhang, J. X.; Li, Y. L.; **Schlom, D. G.;** Chen, L. Q.; Zavaliche, F.; Ramesh, R.; & Jia, Q. X. Phase-field model for epitaxial ferroelectric and magnetic nanocomposite thin films. *Applied Physics Letters* **2007,** *90,* 052909-1 – 052909-3. [Partial support.]

Vasudevarao, A.; Kumar, A.; Tian, L.; Haeni, J. H.; Li, Y. L.; Eklund, C. -J.; Jia, Q. X.; Uecker, R.; Reiche, P.; Rabe, K. M.; Chen, L. Q.; **Schlom, D. G.; Gopalan, V.** Mutiferroic domain dynamics in strained strontium titanate. *Physical Review Letters* **2006,** *97,* 257602-1 – 257602-4. [Primary support.]

Tenne, D. A.; Bruchhausen, A.; Lanzillotti-Kimura, N. D.; Fainstein, A.; Katiyar, R. S.; Cantarero, A.; Soukiassian, A.; Vaithyanathan, V.; Haeni, J. H.; Tian, W.; **Schlom, D. G.;** Choi, K. J.; Kim, D. M.; Eom, C. B.; Sun, H. P.; Pan, X. Q.; Li, Y. L.; Chen, L. Q.; Jia, Q. X.; Nakhmanson, S. M.; Rabe, K. M.; Xi, X. X. Probing nanoscale ferroelectricity by ultraviolet raman spectroscopy. *Science* **2006,** *313,* 1614-1616. [Partial support.]

Patents and Inventions

D. H. Werner, T. S. Mayer, J. A. Bossard, R. P. Drupp, X. Liang, and L. Li, "Reconfigurable Frequency Selective Surfaces for Remote Sensing of Chemical and Biological Agents," Foreign patent application filed on January 14, 2005, Serial No. PCT/US2005/10295. (primary support)

P. S. Weiss and A. Hatzor, "Molecular Rulers for Scaling Down Nanostructures", U. S. Patent 7,015,062 (2006)

J. M. Catchmark, and S. Subramanian, "Fluidic and sorting devices based on catalytically produced electrokinetic phemonena," patent pending.

Invention Disclosures:

D. H. Werner, T. S. Mayer, M. J. Roan, and M. G. Bray, "Chaff Elements for Passive FR and IR Detection of Chem/Bio Agents. "Invention disclosure filed on August 31, 2006, PSU Invention Disclosure Number 2006-3232. (Currently in the process of converting this to a provisional patent application). (partial support)

D. H. Werner, T. S. Mayer, and M. G. Bray, "Chaff Elements for Passive IR Detection of Chem/Bio Agents," Invention disclosure filed on November 21, 2006. PSU Invention Disclosure Number 2006-3270 (Currently in the process of converting this to a provisional patent application). (partial support)

I.C. Khoo and D. H. Werner, "Liquid Crystal Containing Core-shell Nano-spheres for Reconfigurable Optical-,Infrared and Terahertz-Frequency Negative and Zero Index Materails." Invention disclosure filed on May 12, 2006. PSU Invention Disclosure Number 2006-3217. (primary support)

D. H. Werner, T. S. Mayer, and M. Roan, "Passive Detection of Analytes," Provisional patent application filed on June 30, 2006. PSU Invention Disclosure Number 2005-3107. (partial support)

T. S. Mayer and D. H. Werner, "Rectenna-based Infrared and Solar Energy Conversion Arrays Using Self-Assembled Metal-Insulator-Metal Nanowires," Invention disclosure filed on November 98, 2006. PSU Invention Disclosure Number 2006-3256. (partial support)

New Releases

IRG 1

Combining Conventional Lithography with Molecular Self-Assembly for Chemical Patterning was written up in *Advanced Materials* journal ((22 December 2006) on –line at http://www3.interscience.wiley.com/cgi-bin/fulltext/113511106/PDFSTART?CRETRY=1&SRETRY=0

Penn State Eberly College of Science News Story Taking Nanolithography Beyond Semiconductors (14 December 2006)

Nanotechnology Now News Story Taking Nanolithography Beyond Semiconductors (14 December 2006)

EurekAlert News Story Taking Nanolithography Beyond Semiconductors (14 December 2006)

PhysOrg News Story Taking Nanolithography Beyond Semiconductors (14 December 2006)

Nano Tech Wire News Story Taking Nanolithography Beyond Semiconductors (14 December 2006)

First Science Story Taking Nanolithography by Semiconductors (14 December 2006)

Physics News Story Taking Nanolithography Beyond Semiconductors (14 December 2006)

Science Daily News Story Taking Nanolithography Beyond Semiconductors (16 December 2006)

What's Next Network Story Self-Assembled Monolayers Promise to Extend Lithography to Applications beyond Traditional Semiconductors (17 December 2006)

Huliq News Story Taking Nanolithography Beyond Semiconductors (18 December 2006)

Photonics.com Story Taking Nanolithography Beyond Semiconductors (18 December 2006)

Innovations Report Story Taking Nanolithography Beyond Semiconductors (18 December 2006)

Center for Nanoscale Science Nugget Chemical Patterning

Micro/Nano Story **12** (1) Article Surfaces with Varied Chemical Functionality (January 2007)

Penn State Eberly College of Science News Story Microprinting Technique for Patterning Single Molecules (31 January 2007)

Phys.org Story Microprinting Technique for Patterning Single Molecules (1 February 2007)

EurekAlert! Story Microprinting Technique for Patterning Single Molecules (1 February 2007)

Penn State College of Engineering News Story Microprinting Technique is for Patterning Single Molecules (5 February 2007)

Penn State Live Story Microprinting Technique is for Patterning Single Molecules (5 February 2007)

Microprinting Technique is for Patterning Single Molecules (5 February 2007)

AzoNano Story Microcontact Insertion Printing (6 February 2007)

Science Editor's Choice Materials Science: Inserted in Isolation (16 February 2007)

Chemical & Engineering News Story *ACS Nano* Editor is Appointed (5 February 2007)

ACS announces ACS Nano (5 February 2007)

IRG 2

Nanocar: Sub-subcompact (Washingtonpost.com, 4/24/06) and (Spiegel Online [Germany], 4/25/06)

Motor is attached to single-molecule car (Express Newsline [India], 4/13/06) and (Sun Online [London], 4/14/06)

Motor is attached to single-molecule car (Tribune [Chandigarh, India], 4/14/06), (United Press International, 4/12/06), (MSNBC, 4/13/06), (FOXnews.com, 4/14/06), (The Sun [England], 4/14/06), (Hindustan Times [India], 4/14/06), and (NewKerala.com [India], 4/13/06)

Runs on light. Easy to park. And you can't see it. (USA Today, 4/19/06), (CBS News, 4/20/06), and (Wissenschaft.de [Germany],4/15/06)

Big Wheels for Little Cars (Popular Science, 2/06)

Molecular Car Motors Over Gold Highway (DiscoveryChannelNews.com, 3/14/06)

Vehicle landmark (The Courier Mail [Australia], 3/14/06)

Cutting Edge (India Express [Bombay, India], 4/29/06) and (Bangkok [Thailand] Post, 4/26/06)

Students to Test-Drive Rice University's 'Nanocar' Using Early Version of NanoEngineer-1 (Business Wire, 6/20/06) and (TMCnet.com, 6/20/06), and (Canada.com, 6/20/06)

From fullerene-C60 to four-wheelers (Computer Science, 9/10/06)

Creativity provides Tour with nanocar (Small Times Magazine, 9/06-10/06)

Shining a light into nano's uncharted application areas (Small Times Magazine, 9/06-10/06)

Developing a motorized nanocar (Tech Beat, 8/06)

Motorized Nanocars, Nanogenerators and Nanomedical Advances (Environment News Service, 4/17/06)

Small Times Names Rice Chemist Top Nanotech Innovator (Nanotechnology Now, 9/21/06)

Rice University's 'Nanocar' Using Early Version of NanoEngineer (Business Wire, 6/20/06)

Single molecule makes electronic switch (RSC, 8/8/06)

Small Times Names Rice Chemist Top Nanotech Innovator (Technology News Daily, 9/22/06), (PhysOrg.com, 9/21/06), and (Nanotechnology.com, 9/22/06) (EurekAlert!,9/21/06)

Rice University's 'Nanocar' Using Early Version of NanoEngineer (TMCnet, 6/20/06), and (Nanotechwire.com, 6/20/06)

Motorized Nanocars, Nanogenerators and Nanomedical Advances (Small Times, 4/13/06), (EurekAlert, 4/13/06), (Post Chronicle, 4/12/06), (MonstersandCritics.com [UK], 4/12/06), (DailyIndia.com [NY], 4/12/06), (CNETnews.com, 4/12/06), (LinuxElectrons, 4/12/06), (AzoNano.com [Australia], 4/12/06), (Scientia.co.uk [UK], 4/13/06), (LiveScience.com, 4/13/06), (Laser Focus World Magazine, 4/13/06), (Nanotechnology News, 4/13/06), (Nanotechwire.com, 4/13/06), (All Headline News, 4/14/06), (Truckblog.com, 4/14/06)

Motor is attached to single-molecule car (Science Daily [Sandy Hook, CT], 4/12/06), (EurekAlert [DC], 4/12/06), (WDM Solutions, 4/19/06), (Frost & Sullivan, 4/28/06)

Insight (Current Science, 3/3/06)

Nanocar revved up and ready for the track (The Engineer, 4/24/06)

Nanocar rolls on buckyball wheels (AMP Advanced Materials & Processes, 1/06), (ASEE

Prism, 1/1/06)

Light engine drives nanocar (Laser Focus World, 7/1/06)

Nanocars get into top gear (Chemical Science, 9/26/06)

Atomic Drive (Science News for Kids, 8/23/06)

Small is huge: working with tiny things offers giant opportunities for almost everyone (Career World, 9/1/06)

Test Drive for Nanotechnology (ASEE Prism, 1/06)
Foresight Nanotech Institute Announces Feynman Prize Finalists (Business Wire, 8/24/06), (AZoNano.com [Australia], 8/24/06), (IT BusinessNet, 8/24/06), (Nanotechnology News, 8/24/06), (Nanotechwire.com, 8/24/06), (Foresight Nanotech Institute, 8/24/06)

Texas Scores Big in Nanotechnology (PCB007.com, 7/25/06)

Remote sensing (The Independent Online, 5/24/06)

Buckyballs enter the fast lane (RSC, 3/29/06)

Nanotechnology research leads to molecular-scale batteries and motors (EngineerLive, 8/8/06)

Responsible nanotechnology (Euroresidentes.com, 3/14/06)

Texas scores big in nanotechnology (Houston Chronicle, 7/25/06)

Newsradio 740 (KTRH-AM 740, 7/21/06)

The versatile Jim Tour does it again (Houston Chronicle, 4/14/06)

And now, a Really Small Car (Valley News [West Lebanon NH], 5/8/06), (Ithaca [NY] Journal, 4/26/06)

Say, how's the legroom in that nanocar? (Orlando Sentinel, 4/26/06), (Post Star [Riverside NY] and 4/24/06)

Motor is attached to single-molecule car (Washington Times Insider [DC], 4/12/06)

Subcompact: Tiny nanocar now has an engine (The Star-Ledger [NJ], 5/9/06)

World's tiniest 'nanocar' is 20,000 times thinner than a human hair! (Standard Speaker [PA], 4/14/06)

Ultra-tiny car runs on ultraviolet light (Bangor Daily News [ME], 4/25/06)

Briefs (The Advocate, 4/30/06), (Fort Wayne Journal Gazette [IN], 5/1/06), (Watertown Daily Times, 4/30/06), (Scranton Times-Tribune, 4/29/06)

Nanocar is very compact model (San Antonio Express-News, 5/1/06)

IRG 3

Superconducting Nanowires was featured in an article in Science News, vol.169, 206 (2006)

Suppression of Superconductivity in Zinc Nanowires by Bulk Indium Superconductors. Vol. 35, No. 7, 556(2006)

http://www.ems.psu.edu/news/deanfiles/archive/091206.htm

http://www.nciia.org/bmeidea/winners/2006.html

http://www.matse.psu.edu/news/stories/minaAward.html

http://apps.nciia.org/WebObjects/NciiaResources.woa/wa/Read/NewsArticle?n=1000211

http://www.smeal.psu.edu/news/releases/jun06/bmeidea.html

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IRG 4

ìNano-Dispersed Liquid Crystal with Tunable Negative-Zero-Positive Refractive Indices,î Optics and Photonics News, Vol. 17, No. 12, p. 33, (Dec. 2006)

Optics and Photonics News, December 2006 Issue In the metamaterial section, a monthly magazine of The Optical Society of America Optics is a special issue highlighting major significant achievement of 2006 in Optics in 2006; The National Science Foundation; NSF Strategic Plan

"Building Semiconductor Structures in Optical Fiber" Photonics Spectra Article

United Press International

"FET's Inside Optical Fibers" Electronics Weekly

"Semiconductors Grown Inside Optical Fibers" The Engineer

"New Process Builds Electronic Function into Optical Fiber" Photonics Spectra

"Chips with Your Fiber " MIT Technology Review

"The all-fiber network" Telephony Magazine. This article in Telephony Magazine provides an excellent perspective on the advantages of all optical fiber networks

"Smart Fibre Follows its Own Logic" Personal Computer World

"US/UK team builds electronic function into fiber" Laser Focus World

"Semiconductors Infiltrate Microstructured Fibers" Optics & Photonics News

"Optical fiber is also electronic" Laser Focus World

Research News: Electronics in Optical Fibers materialstoday v.9 p. 13 2006

"Holey Fiber" Science Now. Nano World News

"Researchers Fabricate Crystalline Semiconductor Structures Inside Optical Fibers" Frost & Sullivan High Tech Materials Alert (paid subscription navigate to March 31, 2006); Photonics Feature Article; Science News Daily; The Nanotechnology Group; Focus on Materials, Fall 2006

"What's in a Fibre? Towards Fusion of Electronic and Photonic Devices " Nature Materials (need to register)

"Breaking the Mold: Casting on the Nanometre Scale" J.J. Baumberg Nature Materials (must have subscription or institutional access)

"Crossing the Divide" CCNews Magazine.

"Chips Fill Optical Fiber Cores" EE Times spacemart.com

Vice President for Research: Worldwide University Network

Center for Nanoscale Science Nugget "Milestones of Nano" Gonano PSU

"Componentes eletronicos sao construidos no interior de uma fibra optica" Inovacao Tecnologica Macroworld Investor Worldwide University Network Highlights in 2006. See page 7; Worldwide University Network Optoelectronics

"Marrying Semiconductors and Fiber" R&D Magazine

"New Process Electrifies Optical Fiber" The Chemical Engineer (subscription required); Technology News; The Optoelectronics Research Centre (ORC) Website.; Briefing notes David Evans, ORC; PC Magazine; Centre Daily Times; Penn State Live.

"Researchers build electronic functions inside fibre" Fibers.org; Sloan Career Cornerstone News; Chemistry News; The Eberly College of Science Website.; Penn State Materials Science and Engineering News; New Materials International; Digital Collegian; E-composites; Eurek Alert.; Electroptics.com; This advance...; Cbkipa (Korea); The Physorg.com Website.; Chemical Sciences News; Silicon Investor; Wireless Design; The Huff Report; The Innovations Report Website.; The CCNews Website.; Scenta; The Electropages website.; Uran; Test and Measurement; The A to Z of Materials; The A to Z of Nanotechnology; Chemistry News; Research Excellence; Sci/Tech News Service; Science Daily; The HERO webpage; Yubanet; Materials Gate; Nano Tsunami; SFL Org; What's Next in Science & Technology; Society of Manufacturing Engineers; Data Week Electronics & Communication Technology

"New Process Builds Electronics Into Optical Fiber" Science Blog; Slashdot; Kansas City Infozine; Global Glass Net; Fiber Optics Online; High Performance Computing Wire; Photonics Online; The Nanotechwire.com Website; The Brightsurf.com Website; Officer Outlook.com; CCM Sector Invest; Electronline