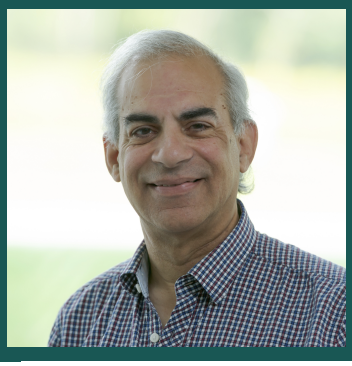
Daniel Rosenmann

Principal Engineering Specialist

Quantum and Energy Materials Group

Center for Nanoscale Materials
Building 440, Room A223
Phone: 630-252-3420
Fax: 630-252-4646
E-mail: rosenmann@anl.gov

Argonne National Laboratory
9700 S Cass Ave., Argonne, IL 60439



Education

M. S. Physics, Northern Illinois University, DeKalb, Illinois, USA
B. S. Physics, Universidad Nacional Mayor de San Marcos, Lima - Peru

Awards and honors

- Tech Connect National Innovation Award, co-awardee (2017)
  New, fast and inexpensive way to grow graphene: Metal-Induced Rapid Transformation of Diamond into Single and Multilayer Graphene on Wafer scale.
- Pacesetter Award, Argonne National Laboratory (2009)
  For extraordinary effort in making sputter and e-beam deposition techniques safely available to CNM staff members and User Community.
- Pacesetter Award, Argonne National Laboratory (2004)
  For exceptional performance at the University of Chicago Review of the Materials Science Division.
- Pacesetter Award, Argonne National Laboratory (1999)
  For extraordinary effectiveness in significantly enhancing the safety standards and inspection readiness of the Materials Science Division.
- Sigma-Pi-Sigma, Physics Honor Society, NIU Chapter (1993)

Research interests

- Design and development of novel "smart probes", which act as detectors for synchrotron x-ray scanning tunneling microscopy (SX-STM), an emerging scanning probe technique for imaging of nanoscale materials, which combines the sub-nanometer spatial resolution of SPM with the chemical, electronic and magnetic sensitivity of synchrotron radiation.
- Synthesis and characterization of heterostructures and metamaterials for photonic applications.
- Synthesis via sputtering or e-beam evaporation of metallic, magnetic and dielectric thin films and heterostructures for plasmonic and superconductivity applications.

Professional Experience

Argonne National Laboratory - Center for Nanoscale Materials (CNM) *2010 - present*
Principal Engineering Specialist

- Design and development of novel "smart probes", which act as detectors for synchrotron x-ray scanning tunneling microscopy (SX-STM), an emerging scanning probe technique for imaging of nanoscale materials, which combines the sub-nanometer spatial resolution of SPM with the chemical, electronic and magnetic sensitivity of synchrotron radiation.
- Synthesis of superconducting, metallic, and dielectric films as well as metamaterials structures for plasmonic and nanophotonics applications.

Argonne National Laboratory - Center for Nanoscale Materials (CNM) *2008 - 2010*
Engineering Specialist Senior

- Major modifications and upgrades to a million –dollar Lesker tool (DC magnetron/ RF sputtering and e-beam evaporator system), such as the design and implementation of a Multi-Leaf Shutter assembly and solving software and component integration issues that prevented this tool from being operational. I received a Pacesetter Award in FY 2009 for this effort.

- User interactions include the training of CNM Users and staff on the use and safe operation of these tools. Safety management responsibilities include the preparation of Standard Operating Procedures and all ancillary efforts to safe operation of the scientific instruments.

Argonne National Laboratory – Materials Science Division (MSD) *2001 - 2008*
Scientific Associate Senior

- Synthesis of high quality single crystals of the high temperature superconductor $YBa_2Cu_3O_{7-d}$ with flux method using a Lindberg/Blue box furnace.
- Initiated and developed techniques for synthesizing ultra-high purity and impurity doped $NbSe_2$ single crystals with the vapor transport method using a three-zone furnace.
- Took the lead in synthesizing single crystals of the newly discovered graphite intercalation superconductors CaC_6, YbC_6, and SrC_6 and quickly established Argonne as the lead of these unique crystals. Characterization of magnetic and structural properties of these and other samples with SQUID magnetometry (Quantum Design System) and X-ray diffraction (Rigaku Geigerflex and Phillips closed x-ray Xpert/PRO diffractometers), respectively.
- Engineered the design and installation from ground up of a custom-built UHV sputtering system for the deposition of metallic films and multilayers. Work included the design and fabrication of a power supply unit for thermally baking the chamber and the ion pump, the fabrication of a home-built control panel to remotely activate pneumatic valves and pumps and the design and implementation of a novel semi-automatic manipulator to transfer samples from the load-lock to the sputtering chamber. This system was instrumental in the research on high-speed hydrogen sensors that won an R&D100 Award in 2006.

Argonne National Laboratory – Materials Science Division (MSD) *1996 - 2001*
Scientific Associate

- Design and operation of a multiple furnace-based sample preparation laboratory in support of a leading research program in superconductivity. Activities included establishing thermal annealing parameters for crystal growth of high temperature superconductors and vapor depositing electrical contacts or protective coatings onto these materials using a E6700 Polaron Turbo Vacuum Evaporator.
- Design of a custom turbomolecular-based high vacuum pumping system to resolve vacuum contamination problems. Troubleshooting and repair of vacuum leaks in cryogenic systems using leak detectors.

Northern Illinois University – Physics Department *1994 - 1996*
Research Laboratory Manager, Mossbauer Effect Laboratory

- Responsible for operation and assembly of Mossbauer spectrometers and implementing computer data acquisition systems. Computer analysis and graphical representation of the experimental and modeled data.
- Research on optically-induced electronic transitions in perovskite materials using Mossbauer spectroscopy with focus on charge fluctuations and their effect on magnetism and phase stability

Selected Publications

Synchrotron x-ray imaging, scanning tunneling microscopy (SX-STM)

1. H. Chang, N. Shirato, Y. Zhang, J. Hoffman, D. Rosenmann, J. W. Freeland, A. Bhattacharya, V Rose, S-W. Hla. *X-ray magnetic circular dichroism and near-edge x-ray absorption fine structure of buried interfacial magnetism measured by using a scanning tunneling microscope tip.* ***Appl. Phys. Lett.*** **113**, 061602 (2018)

2. H. Kersell, N. Shirato, M. Cummings, H. Chang, D. Miller, D. Rosenmann, S.-W. Hla, and Volker Rose. *Detecting element specific electrons from a single cobalt nanocluster with synchrotron x-ray scanning tunneling microscopy.* ***Appl. Phys. Lett.*** **111**, 103102 (2017)
3. M. Cummings, N. Shirato, H. Kersell, H. Chang, D. Rosenmann, J. Freeland, D. Miller, S.-W. Hla, and Volker Rose. *Controlled modulation of hard and soft x-ray induced tunneling currents utilizing coaxial metal-insulator-metal probe tips.* ***J. Appl. Phys.*** **121**, 015305 (2017)
4. DiLullo, N. Shirato, M. Cummings, H. Kersell, H. Chang, D. Rosenmann, D. Miller, J. Freeland, S-W. Hla, and V. Rose. *Local x-ray magnetic circular dichroism study of Fe/Cu(111) using a tunneling smart tip.* ***J. Synchrotron Rad.*** **23,** 574–578 (2016)
5. H. Yan, M. Cummings, F. Camilo, W. Xu, M. Lu, X. Tong, N. Shirato, D. Rosenmann, V. Rose, and E. Nazaretski. *Fabrication and characterization of CNT-based smart tips for synchrotron assisted STM.* ***J. Nanomaterials*** **15**, 492657–492663 (2015)
6. N. Shirato, M. Cummings, H. Kersell, Y. Li, B. Stripe, D. Rosenmann, S.-W. Hla, and V. Rose. *Elemental fingerprinting of materials with sensitivity at the atomic limit*. ***Nano Lett.*** **14**, 6499–6504 (2014)
7. K. Wang, D. Rosenmann, M. Holt, R. Winarski, S.-W. Hla, V. Rose. *An easy-to-implement filter for separating photo-excited signals from topography in scanning tunneling microscopy.* **Rev. Sci. Instrum**. **84**, 063704 (2013)
8. V. Rose, K. Wang, T.Y. Chien, J. Hiller, D. Rosenmann, J.W. Freeland, C. Preissner, S.-W. Hla. *Synchrotron x-ray scanning tunneling microscopy: Fingerprinting near to far field transitions on Cu(111) induced by synchrotron radiation.* **Adv. Funct. Mater**. **23**, 2646 - 2652 (2013)
9. V. Rose, T.Y. Chien, J.W. Freeland, D. Rosenmann, J. Hiller, V. Metlushko. *Spin-dependent synchrotron x-ray excitations studied by scanning tunneling microscopy.* **J. Appl. Phys**. **111**, 07E304 (2012)
10. V. Rose, T.Y. Chien, J. Hiller, D. Rosenmann, and R.P. Winarski. *X-ray nanotomography of SiO_2 – coated $Pt_{90}Ir_{10}$ tips with sub-micron conducting apex.* **Appl. Phys. Lett. 99**, 173102 (2012)
11. R.A. Rosenberg, S. Zohar, D. Keavney, R. Divan, D. Rosenmann, K.A. Mascarenhas and M.A. Steiner. *Elemental and magnetic sensitive imaging using x-ray excited luminescence microscopy.* **Rev. Sci. Instrum**. **83**, 073701 (2012)

Metamaterials and plasmonic materials for optical applications

12. N. Jeon, J. Hernandez, D. Rosenmann, S. K. Gray, A. B.F. Martinson, J. J. Foley IV**.** *Pareto optimal spectrally selective emitters for thermophotovoltaics via weak absorber critical coupling.* ***Adv. Energy Mater*** **8**, 1801035 (2018)
13. M. E. Sykes, J. W. Stewart, G. M. Akselrod, X-T. Kong, Z. Wang, D. J. Gosztola, A. B. F. Martinson, D. Rosenmann, M. H. Mikkelsen, A. O. Govorov, G. P. Wiederrecht. *Enhanced generation and anisotropic coulomb scattering of hot electrons in an ultra-broadband plasmonic nanopatch metasurface.* ***Nature Communications*** **8**, 986 (2017)
14. W. Wang, D. Rosenmann, D. A. Czaplewski, X. Yang and J. Gao. *Realizing structural color generation with aluminum plasmonic v-groove metasurfaces.* ***Opt. Express*** **25** (17), 20454-20465 (2017)
15. Z. Li, W. Wang, D. Rosenmann, D. A. Czaplewski, X. Yang and J. Gao. *All-metal structural color printing based on aluminum plasmonic metasurfaces.* ***Opt. Express*** **24**, 20472-20480 (2016)
16. F. Cheng, X. Yang, D. Rosenmann, D. Czaplewski, L. Stan, and J. Gao. *Enhanced structural color generation in aluminum metamaterials coated with a thin polymer layer*. ***Opt. Express*** **23** (19), 25329–25339 (2015).
17. H. Harutyunyan, A.B.F. Martinson, D. Rosenmann, L.K. Khorashad, L.V. Besteiro, A.O. Govorov, and G.P. Wiederrecht. *Anomalous ultrafast dynamics of hot plasmonic electrons in nanostructures with hot spots.* ***Nature Nanotechnology*** **10**, 770–774 (2015).
18. P. Ahn**,** X. Chen, Z. Zhang, M. Ford, D. Rosenmann, I.W. Jung, C. Sun, O. Balogun. *Dynamic near-field optical interaction between oscillating nanomechanical structures.* ***Scientific Reports*** **5**, 10058 (2015)

19. H. Deng, Z. Li, L. Stan, D. Rosenmann, D. Czaplewski, J. Gao, and X. Yan. *Broadband perfect absorber based on one ultrathin layer of refractory metal.* ***Opt. Lett.*** **40**, 2592–2595 (2015)
20. F. Cheng, J. Gao, L. Stan, D. Rosenmann, D. Czaplewski, and X. Yang. *Aluminum plasmonic metamaterials for structural color printing.* ***Opt. Express*** **23**, 14552–14560 (2015)
21. J.J. Foley, H. Harutyunyan, D. Rosenmann, R. Divan, G.P. Wiederrecht, and S.K. Gray. *When are surface plasmon polaritons excited in the Kretschmann-Raether configuration?* ***Scientific Reports*** **5**, 9929 (2015)
22. E. Palacios**,** A. Chen, J. Foley, S. Gray, U. Welp, D. Rosenmann, and V. Vlasko-Vlasov. *Ultra-confined modes in metal nanoparticle arrays for subwavelength light guiding and amplification.* ***Adv. Optical Mater.*** **2**, 394–399 (2014).
23. X. Yang, C.Hu, H. Deng, D. Rosenmann, D. Czaplewski, and J. Gao. *Experimental demonstration of near-infrared epsilon-near-zero multilayer metamaterials slabs.* **Optics Express 21**, 23631-23639 (2013)

Synthesis of metallic, magnetic, and dielectric films and heterostructures for diverse applications

24. S. Sonde, B. Chakrabarti, Y. Liu, K. Sasikumar, J. Lin, L. Stan, R. Divan, L. Ocola, D. Rosenmann, P. Choudhury, K. Ni, S. Sankaranarayanan, S. Datta, S. Guha. *Silicon compatible Sn-based resistive switching memory.* ***Nanoscale*** **10**, 9441-9449 (2018)
25. J. M. Logan, D. Rosenmann, T. Sangpo, M. V. Holt, P. Fuesz, I. McNulty. *Tungsten-encapsulated gadolinium nano-islands with enhanced magnetocaloric response.* ***Appl. Phys. Lett.*** **111**, 013105 (2017)
26. K. Li, M. Wojcik, R. Divan, L. Ocola, B. Shi, D. Rosenmann and C. Jacobsen. *Fabrication of hard x-ray zone plates with high aspect-ratio using metal-assisted chemical etching.* **J. Vac. Sci. Technol**. B **35**, 06G901 (2017)
27. D. Berman, S. Deshmukh, B. Narayanan, S. Sankaranarayanan, Z. Y., A. A. Balandin, A. Zinovev, D. Rosenmann, A. V. Sumant. *Metal-induced rapid transformation of diamond into single and multilayer graphene on wafer scale.* ***Nature Communications*** **7**, 12099 (2016)
28. O. V. Makarova**,** D. Adams, R. Divan, D. Rosenmann, P. Zhu, S. Li, P. Amstutz, C-M. Tang. *Polymer microfilters with nanostructured surfaces for the culture of circulating cancer cells.* ***Mat. Sci. Eng. C*** **66**, 193-198 (2016)
29. Md Humayun, R. Divan, L. Stan, D. Rosenmann, D. Gosztola, L. Gundel, P. Solomon, I. Paprotny. *Ubiquitous low-cost functionalized multi-walled carbon nanotube sensors for distributed methane leak detection.* **IEEE Sensors Journal**, **PP**, Iss. 99 (2016)
30. A. Kinaci, M. Kado, D. Rosenmann, C. Ling, G. Zhu, D. Banerjee, M.K.Y. Chan. *Electronic transport in VO_2 – experimentally-calibrated Boltzmann transport modeling.* ***Appl. Phys. Lett.*** **107**, 262108 (2015)
31. L.E. Ocola, D. Gosztola, D. Rosenmann, G. Lopez. *Automated geometry assisted proximity effect correction for electron beam direct write nanolithography*. **J. Vac. Sci. Technol. B 33**, 06FD02 (2015)
32. Md Humayun, R. Divan, L. Stan, A. Gupta, D. Rosenmann, L. Gundel, P. Solomon, I. Paprotny. *ZnO functionalization of multi-walled carbon nanotubes for methane sensing at single parts per million concentrations levels.* **J. Vac. Sci. Technol. B 33**, 06FF01 (2015)
33. J.M. Logan, H.C. Kim, D. Rosenmann, Z. Cai, R. Divan, O.G. Shpyrko, E.D. Isaacs. *Antiferromagnetic Domain Wall Engineering in Chromium Films.* **Appl. Phys. Lett. 100**, 192405 (2012)
34. G. Lu; S. Park, K. Yu; R. Ruoff, L. Ocola, D. Rosenmann, J. Chen. *Toward practical gas sensing using highly reduced graphene oxide: A new signal processing method to circumvent run-to-run and device-to-device variations.* **ACS Nano**, **5** (2), 1154-1164 (2011)
35. T. Xu, M.P. Zach, Z. L. Xiao, D. Rosenmann, U. Welp, W. K. Kwok, G. W. Crabtree. *Self-assembled monolayer-enhanced hydrogen sensing with ultrathin palladium films.* **Appl. Phys. Lett**. **86**, 203104 (2005)

Superconductivity

36. V.K. Vlasko-Vlasov, F. Colauto, T. Benseman, D. Rosenmann, W.-K. Kwok. *Guiding thermomagnetic avalanches with soft magnetic stripes.* ***Phys. Rev. B*** **96**, 214510 (2017)
37. V.K. Vlasko-Vlasov, F. Colauto, A.I. Buzdin, D. Rosenmann, T. Benseman, W.-K. Kwok. *Manipulating Abrikosov vortices with soft magnetic stripes.* ***Phys. Rev.*** **B 95**, 174514 (2017)
38. V.K. Vlasko-Vlasov, F. Colauto, A.I. Buzdin, D. Rosenmann, T. Benseman, W.-K. Kwok. *Magnetic gates and guides for superconducting vortices.* ***Phys. Rev. B*** **95**, 144504 (2017)
39. V. K. Vlasko-Vlasov, F. Colauto, T. Benseman, D. Rosenmann, W.-K Kwok. *Triode for magnetic flux quanta.* ***Sci. Rep.*** **6**, 36847 (2016)
40. V. K. Vlasko-Vlasov, F. Colauto, A. Buzdin, D. Carmo, A. Andrade, A. Olivera, W. Ortiz, D. Rosenmann, W.-K Kwok. *Crossing fields in thin films of isotropic superconductors.* ***Phys. Rev. B*** **94**, 184502 (2016)
41. T. Cecil, A. Miceli, O. Quaranta, C. Liu, D. Rosenmann, S. McHugh, and B.A. Mazin. *Tungsten Silicide Films for Kinetic Inductance Detectors.* **Appl. Phys. Lett. 101**, 032601 (2012)
42. V. Vlasko-Vlasov, A. Buzdin, A. Melnikov, U. Welp, D. Rosenmann, L. Uspenskaya, V. Fratello and W. Kwok. *Domain Structure and Magnetic Pinning in Ferromagnetic/Superconducting Hybrids.* **Phys. Rev. B 85**, 064505 (2012)
43. V. Vlasko-Vlasov, U. Welp, W. Kwok, D. Rosenmann, H. Claus, A. A. Buzdin, A. Melnikov. *Coupled Domain Structures in superconductor/ferromagnet Nb-Fe/garnet bilayers.* **Phys. Rev. B 82**, 100502, Rapid Communication (2010)
44. M. Iavarone, G. Karapetrov, J. Fedor, D. Rosenmann, T. Nishizaki, N. Kobayashi. *The Local Effect of Magnetic Impurities on Superconductivity Co_xNbSe_2 and Mn_xNbSe_2 Single Crystals.* **J. Physics.: Condens. Matter 22**, No 1, 015501 (2010)
45. M. Debessai, J.J Hamlin, J.S Schilling, D. Rosenmann, D.G. Hinks, and H. Claus. *Superconductivity for CaC_6 to 32 GPa Hydrostatic Pressure.* **Phys. Rev. B 82**, 132502 (2010)
46. D. Di Castro, A. Kanigel, A. Maisuradze, A. Keren, P. Postorino, D. Rosenmann, U. Welp, G. Karapetrov, H. Claus, D. G. Hinks, A. Amato, and J. C. Campuzano. *Muon Spin Rotation of the Magnetic Penetration Depth in the Intercalated Graphite Superconductor CaC_6.* **Phys. Rev. B 82**, 014530 (2010)
47. V. K. Vlasko-Vlasov, U. Welp, A. Imre, D. Rosenmann**,** J. Pearson, and W. -K. Kwok. *Soft Magnetic Lithography and Giant Magnetoresistance in Superconducting / Ferromagnetic Hybrids.* **Phys. Rev. B 78**, 214511 (2008)
48. M. Iavarone, R. Di Capua, G. Karapetrov, A. E. Koshelev, D. Rosenmann, H. Claus, C. D. Malliakas, M. G. Kanatzidis, T. Nishizaki, N. Kobayashi. *Effect of Magnetic Impurities on the Vortex Lattice Properties in $NbSe_2$ Single Crystals.* Phys. Rev. B **78**, 174518 (2008)
49. V. Vlasko-Vlasov, U. Welp, G. Karapetrov, V. Novosad, D. Rosenmann, M. Iavarone, A. Belkin, W.-K. Kwok. *Guiding Superconducting Vortices by Magnetic Domain Walls.* **Phys. Rev. B 77**, 134518 (2008)
50. C. Kurter, L. Ozyuzer, Daniel Mazur, J. F. Zasadzinski, D. Rosenmann, H. Claus, D. Hinks, and K. E. Gray. *Large energy gap in CaC_6 from Tunneling Spectroscopy: Possible evidence of strong-coupling superconductivity.* **Phys. Rev. B 76**, 220502 (2007)
51. D.G. Hinks, D. Rosenmann, H. Claus, M. S. Bailey, J. D. Jorgensen. *Large Ca Isotope Effect in the CaC_6 Superconductor.* **Phys. Rev. B 76**, 220502 (2007)
52. G. Karapetrov, J. Fedor, M. Iavarone, D. Rosenmann, and W. K. Kwok. *Direct Observation of Geometrical Phase Transitions in Mesoscopic Superconductors by Scanning Tunneling Microscopy.* **Phys Rev Lett 95**, 167002 (2005)

Patents

- V. Rose; K.K. Wang, C. Preissner, S.-W. Hla, and D. Rosenmann (2014), *Method for Simultaneous Topographic and Elemental, Chemical, and Magnetic Contrast in Scanning Tunneling Microscopy (SX-STM).* **U.S. Patent** 8,850,611