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**Xi Huang**

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**Education**

Univ. of Sci. and Tech. of China (China)

University of Nebraska-Lincoln (UNL, USA)

Physics, B. S. 2007-2011

Electrical Engineering, Ph.D. 2011-2016

**Research Experience**

**Postdoctoral Researcher | Laser-assisted Nano-engineering Laboratory, UNL, Lincoln, NE | 2017**–**present**

**Equipment management and maintenance:**

* Home-made atmospheric pressure chemical vapor deposition (AP-CVD) system.
* DC/RF sputtering system.
* Laser spectroscopic/microscopic systems: coherent Raman, second harmonic generation (SHG), two photon excitation fluorescence (TPEF), spontaneous Raman, laser-induced breakdown spectroscopy (LIBS), laser-assisted mass spectrometry (LAMS), and absorption spectroscopy.
* Laser systems: high power quasi continuous wave (QCW) lasers, Q-switched Nd:YAG pulsed lasers, KrF Excimer lasers, ultra-short-pulse lasers (ps/fs), and fiber lasers.
* Optics and light analysis tools: Lenses, HR mirrors, optical filters, beam splitters, beam expanders, prisms, polarizers, wave plates, photo detectors, spectrometers, laser power meters, and optical alignment tools.
* Surface morphology characterization: Zygo 3D optical profiler and Agilent SPM.
* KUKA robot arm.

**Material research:**

* In charge of CNT growth on various wafers by AP-CVD.
* Conducted optical coupling investigation/simulation of hybrid MoS2 structures (MoS2/Ferroelectric, MoS2/TiO2 nanowire).
* Led a project “Investigation of coating degradation mechanisms induced by fungi using open-air laser spectroscopy and spectrometry”. Through tracking the nutrient elements loss of coating after fungus attack, the coating degradation mechanisms have been investigated.

**Laser surface processing:**

* Laser surface desensitization for severely sensitized 5xxx Al-Mg alloy.
* Developing a laser repairing system for sensitized alloy plates using a KUKA robot arm and an industrial grade high power fiber laser.

**Laser spectroscopy/microscopy:**

* Led defect investigation of targets used for inertial confinement fusion using 3D imaging.
* Conducted exosome characterization and spectral data analysis by spontaneous Raman and machine learning for early detection of pancreatic cancer.
* Designed and developed a flexible fiber-based laser beam delivery system for nonlinear imaging.

**Grant applications and student mentoring:**

* Led preparation of research proposals/whitepapers for various funding sources (NIH, DOD, DTRA, NAVSEA, and USAFA).
* Mentoring graduate students and providing continuous guidance and support.

**Research Assistant | Laser-assisted Nano-engineering Laboratory, UNL, Lincoln, NE | 2011**–**2016**

* Led a NSF project to develop a multi-functional imaging and spectroscopic measurement system (CARS, SHG, and TPEF) at the cellular scale.
* Led collaboration with University of Nebraska Medical Center (UNMC) and research groups at UNL for bio-imaging and spectroscopic measurement of cellular systems, including microalgae cells, porcine carotid arterial walls, mouse liver cells and tissues, human muscle tissues, mouse breast cancer tissues, and mouse pancreatic cancer tissues in multiple biological and biomedical application projects.
* Utilized Principal Component Analysis (PCA) and Discrimination Analysis (DA) via R software for disease discrimination and diagnosis based on obtained Raman and CARS spectra.
* Programed for automated data acquisition and system communication among multiple instruments (lasers, 3D motorized stages, spectrometer, and digital delay generator) to realize a 3D LIBS mapping platform.
* Utilized a monolayer of silica microspheres for imaging signal enhancement and simulated the enhancement conditions by Finite-Difference Time-Domain (FDTD) method.
* Led and assisted preparation of research proposals/whitepapers for various funding sources (DOD, DOE, DTRA, ONR, and NSF). One proposed research project was funded on FY2017 (SERDP WP-2744).

**Teaching Assistant | Department of Electrical and Computer Engineering, UNL, USA | 2012**–**2013**

* Taught an Electrical Engineering lab course for undergraduates.
* Managed a group of 25 undergraduate students.

**Participation in Research Projects**

* Nanoscale Ferroelectric Control of Novel Electronic States in Layered Two-Dimensional Materials (DE-SC0016153)
* Investigation of Coating Degradation Mechanisms Induced by Fungi Using Open-air Laser Spectroscopy and Spectrometry (SERDP WP-2744)
* Vertically Applied Carbon Nanotube Embedded in Ceramic Materials For Hot Electrode Applications (DE-FE0023061)
* Portable Fiber Laser System and Method to Remove Pits and Cracks on Sensitized Surfaces of Aluminum Alloys. (ONR N00014-15-C-0087)
* Post-Detonation Radiological and Nuclear Forensics Using Laser-Assisted Mass Spectrometry in Open Air. (DTRA)
* MRI: Development of Multifunctional CARS (Coherent Anti-Stokes Raman Spectroscopy) Imaging System (NSF 1126208)

**Publications (Total Citation: 475)**

**Under preparation:**

* L. Liu, **X. Huang (contributed equally)** , Y. Lu , L. Fan, L. Jiang, J.F. Silvain, and Y.F. Lu, “Laser-induced Breakdown Spectroscopy Combined with Multivariate Analysis for Investigation of Chemical Element Variation in Coatings Induced by Aspergillus Niger Corrosion”, under preparation.
* **X. Huang**, L. Liu, Y. Lu , L. Jiang, J.F. Silvain, and Y.F. Lu, “Raman Spectroscopy Combined with PC-DFA Methodology for Investigation of Chemical Variation in Coating Bio-corrosion by Aspergillus Niger”, under preparation.

**Under review:**

* D. W. Li, **X. Huang (contributed equally)**, Z. Xiao, H. Chen, L. Zhang, J. Song, D. Shao, E. Y. Tsymbal, Y.F. Lu, and X. Hong, “Symmetry-Mediated Interfacial Optical Coupling in MoS2/Ferroelectric Composite Structures”, submitted to Nature Communications.
* D. W. Li, C. Wei, J. Song, **X. Huang**, F. Wang, K. Liu, W. Xiong, X. Hong, B. Cui, A. Feng, L. Jiang, Y.F. Lu, “Anisotropic Enhancement of Second Harmonic Generation in Monolayer and Bilayer MoS2 by Integrating with TiO2 Nanowires”, submitted to Nano Lett and under revision.

**Published:**

1. J. Carmicheal, C. Hayashi, **X. Huang (contributed equally)**, L. Liu, Y. Lu, A. Krasnoslobodtsev, A. Lushnikov, P. G. Kshirsagar, A. Patel, and M. Jain, "Label-free characterization of exosome via surface enhanced Raman spectroscopy for the early detection of pancreatic cancer," Nanomedicine: Nanotechnology, Biology and Medicine 16, 88-96 (2019).
2. **X. Huang**, Y. Yuan, T. A. Bielecki, B. C. Mohapatra, H. T. Luan, E. Silva-Lopez, W. W. West, V. Band, Y. F. Lu, H. Band, and T. C. Zhang, "Discrimination of tumor from normal tissues in a mouse model of breast cancer using CARS spectroscopy combined with PC-DFA methodology," J Raman Spectrosc 48, 1166-1170 (2017).
3. **X. Huang**, S. Irmak, Y. Lu, I. Pipinos, G. Casale, and J. Subbiah, "Spontaneous and coherent anti-Stokes Raman spectroscopy of human gastrocnemius muscle biopsies in CH-stretching region for discrimination of peripheral artery disease," Biomed Opt Express 6, 2766-2777 (2015).
4. **X. Huang**, X. He, W. Xiong, Y. Gao, L. Jiang, L. Liu, Y. Zhou, L. Jiang, J. Silvain, and Y. Lu, "Contrast enhancement using silica microspheres in coherent anti-Stokes Raman spectroscopic imaging," Opt Express 22, 2889-2896 (2014).
5. Y. Liu, W. Xiong, D. Li, Y. Lu, **X. Huang**, H. Liu, L. Fan, L. Jiang, J.-F. Silvain, and Y. Lu, "Precise Assembly and Joining of Silver Nanowires in Three Dimensions for Highly Conductive Composite Structures," International Journal of Extreme Manufacturing (2019).
6. D. Li, Z. Xiao, S. Mu, F. Wang, Y. Liu, J. Song, **X. Huang**, L. Jiang, J. Xiao, and L. Liu, "A facile space-confined solid-phase sulfurization strategy for growth of high-quality ultrathin molybdenum disulfide single crystals," Nano Lett 18, 2021-2032 (2018).
7. K. Keramatnejad, H. R. Golgir, L. Constantin, **X. Huang**, Q. M. Zou, J.-F. Silvain, S. Ducharme, and Y. F. Lu, "Multi-walled carbon nanotube-coated spiral coils for loss reduction in wireless power transfer systems," Carbon 139, 695-699 (2018).
8. L.S. Fan, L. Constantin, D.W. Li, L. Liu, K. Keramatnejad, C. Azina, **X. Huang**, H. R. Golgir, Y. Lu, and Z. Ahmadi, "Ultraviolet laser photolysis of hydrocarbons for nondiamond carbon suppression in chemical vapor deposition of diamond films," Light: Science & Applications 7, 17177 (2018).
9. Y. S. Zhou, Y. Lu, M. M. Wang, L. Liu, **X. Huang**, L. J. Jiang, L. Jiang, J.-F. Silvain, and Y. F. Lu, "Isotope signature characterization of Pb and U in open air by laser-ablation mass spectrometry," Journal of Analytical Atomic Spectrometry 32, 1932-1937 (2017).
10. L. Liu, L. Deng, L. Fan, **X. Huang**, Y. Lu, X. Shen, L. Jiang, J.-F. Silvain, and Y. Lu, "Time-resolved resonance fluorescence spectroscopy for study of chemical reactions in laser-induced plasmas," Opt Express 25, 27000-27007 (2017).
11. S. Li, L. Liu, A. Yan, S. Huang, **X. Huang**, R. Chen, Y. Lu, and K. Chen, "A compact field-portable double-pulse laser system to enhance laser induced breakdown spectroscopy," Review of Scientific Instruments 88, 023109 (2017).
12. D. Li, Q. Zou, **X. Huang**, H. R. Golgir, K. Keramatnejad, J. Song, Z. Xiao, L. Fan, X. Hong, and L. Jiang, "Controlled defect creation and removal in graphene and MoS 2 monolayers," Nanoscale 9, 8997-9008 (2017).
13. Y. Lei, D. Li, T. Zhang, **X. Huang**, L. Liu, and Y. Lu, "One-step selective formation of silver nanoparticles on atomic layered MoS 2 by laser-induced defect engineering and photoreduction," Journal of Materials Chemistry C 5, 8883-8892 (2017).
14. S. Li, L. Liu, R. Chen, B. Nelsen, **X. Huang**, Y. Lu, and K. Chen, "Development of a compact vertical-cavity surface-emitting laser end-pumped actively Q-switched laser for laser-induced breakdown spectroscopy," Review of Scientific Instruments 87, 033114 (2016).
15. D. Li, W. Xiong, L. Jiang, Z. Xiao, H. Rabiee Golgir, M. Wang, **X. Huang**, Y. Zhou, Z. Lin, and J. Song, "Multimodal nonlinear optical imaging of MoS2 and MoS2-based van der Waals heterostructures," ACS nano 10, 3766-3775 (2016).
16. L. Jiang, W. Xiong, Y. Zhou, Y. Liu, **X. Huang**, D. Li, T. Baldacchini, L. Jiang, and Y. Lu, "Performance comparison of acrylic and thiol-acrylic resins in two-photon polymerization," Opt Express 24, 13687-13701 (2016).
17. H. R. Golgir, Y. S. Zhou, D. Li, K. Keramatnejad, W. Xiong, M. Wang, L. J. Jiang, **X. Huang**, L. Jiang, and J. F. Silvain, "Resonant and nonresonant vibrational excitation of ammonia molecules in the growth of gallium nitride using laser-assisted metal organic chemical vapour deposition," Journal of Applied Physics 120, 105303 (2016).
18. Y. Lu, Y. S. Zhou, W. Qiu, **X. Huang**, L. Liu, L. Jiang, J.-F. Silvain, and Y. F. Lu, "Magnetic field enhancement for femtosecond-laser-ablation mass spectrometry in ambient environments," Journal of Analytical Atomic Spectrometry 30, 2303-2306 (2015).
19. Y. Lu, Y. S. Zhou, W. Qiu, **X. Huang**, Y. Gao, L. Liu, Y. Lei, T. C. Zhang, L. Jiang, and J.-F. Silvain, "Sensitivity and intensity enhancement in open air mass spectrometry assisted with a continuous wave infrared laser," Journal of Analytical Atomic Spectrometry 30, 1663-1667 (2015).
20. L. Liu, S. Li, **X. Huang**, Y. Lu, K. Chen, R. Pik, L. Jiang, J. F. Silvain, and Y. F. Lu, "Detection of trace-level uranium and samarium in glasses by combined laser-induced breakdown spectroscopy and plasma-induced fluorescence spectroscopy," Journal of Analytical Atomic Spectrometry 30, 1128-1132 (2015).
21. L. Liu, **X. Huang**, S. Li, Y. Lu, K. Chen, L. Jiang, J.-F. Silvain, and Y. F. Lu, "Laser-induced breakdown spectroscopy enhanced by a micro torch," Opt Express 23, 15047-15056 (2015).
22. L. Liu, S. Li, X. He, **X. Huang**, C. Zhang, L. Fan, M. Wang, Y. Zhou, K. Chen, and L. Jiang, "Flame-enhanced laser-induced breakdown spectroscopy," Opt Express 22, 7686-7693 (2014).
23. L. J. Jiang, Y. S. Zhou, W. Xiong, Y. Gao, **X. Huang**, L. Jiang, T. Baldacchini, J.-F. Silvain, and Y. F. Lu, "Two-photon polymerization: investigation of chemical and mechanical properties of resins using Raman microspectroscopy," Optics letters 39, 3034-3037 (2014).
24. Y. Gao, Y. S. Zhou, W. Xiong, M. Wang, L. Fan, H. Rabiee-Golgir, L. Jiang, W. Hou, **X. Huang,** and L. Jiang, "Highly efficient and recyclable carbon soot sponge for oil cleanup," ACS applied materials & interfaces 6, 5924-5929 (2014).
25. L. S. Fan, W. Xiong, L. J. Jiang, W. J. Hou, **X. Huang**, L. Liu, Y. S. Zhou, and Y. F. Lu, "Fabrication of graphene patterns directly on SiO2/Si substrates using laser-induced chemical vapor deposition," in International Congress on Applications of Lasers & Electro-Optics(LIA, 2014), pp. 1215-1219.
26. K. Cluff, A. M. Kelly, P. Koutakis, X. N. He, **X. Huang**, Y. F. Lu, I. I. Pipinos, G. P. Casale, and J. Subbiah, "Surface enhanced Raman spectral biomarkers correlate with Ankle Brachial Index and characterize leg muscle biochemical composition of patients with peripheral arterial disease," Physiological reports 2 (2014).
27. Y. Gao, Y. S. Zhou, M. Qian, H. M. Li, J. Redepenning, L. S. Fan, X. N. He, W. Xiong, **X. Huang**, and M. Majhouri-Samani, "High-performance flexible solid-state supercapacitors based on MnO 2-decorated nanocarbon electrodes," RSC Advances 3, 20613-20618 (2013).
28. Y. Gao, Y. Zhou, W. Xiong, L. Jiang, M. Mahjouri-Samani, P. Thirugnanam, **X. Huang**, M. Wang, L. Jiang, and Y. Lu, "Transparent, flexible, and solid-state supercapacitors based on graphene electrodes," APL materials 1, 012101 (2013).
29. X. He, J. Allen, P. N. Black, T. Baldacchini, **X. Huang**, H. Huang, L. Jiang, and Y. Lu, "Coherent anti-Stokes Raman scattering and spontaneous Raman spectroscopy and microscopy of microalgae with nitrogen depletion," Biomed Opt Express 3, 2896-2906 (2012).