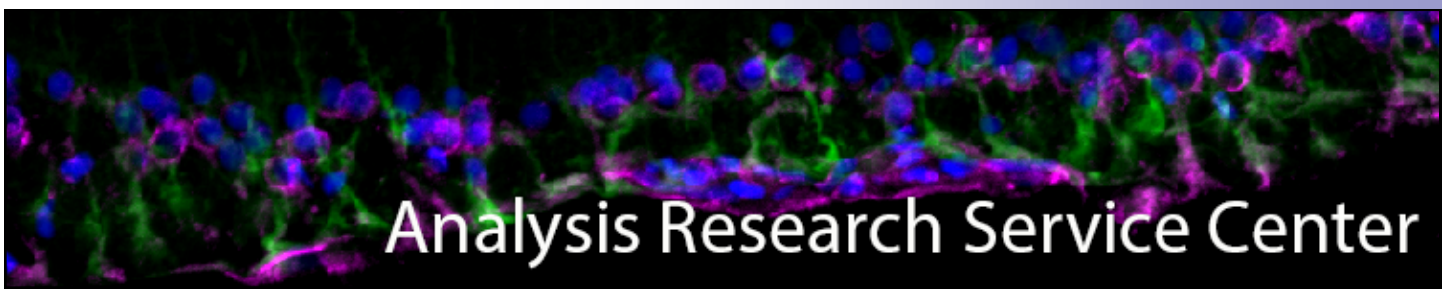
Texas State University



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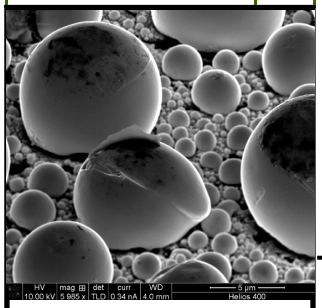

Tin Balls—Micrograph by Dr. Juan Gomez

ARSC Message

The Analysis Research Service Center (ARSC) continues to play a significant role in supporting the Texas State research mission. This fee-based facility addresses many needs for advanced characterization of materials and devices. Multidisciplinary collaboration continues to bring in new (or new to the ARSC) equipment. Over the past year we have included an ellipsometer (ESM-300); a UV - Vis Spectrometer (UV-2501 (PC)); a Surface Profilometer (Bruker Dektak XT); a Critical Point Dryer (EM CPD 300); a scanning electron microscope (JEOL); and just coming on-line, the new Horiba Evolution Raman AFM microscope. There is another new AFM in the works as well as equipment proposals underway for additional equipment such as a new transmission electron microscope.

The success of this endeavor relies heavily both on the excellent management and training provided by the ARSC staff in conjunction with the collaborative efforts of faculty in obtaining new equipment.

Students receive expert training to achieve in-depth understanding of sophisticated instrumentation. This knowledge, and the Analysis RSC, will have a sustained impact on our ongoing and future research advancements.

Our equipment and facilities, located in laboratories across campus, are available to University personnel and external users who have established a relationship with Texas State University. Equipment-specific safety/operation training and certification, under the guidance of highly experienced technical staff members, allows users to customize the resources they bring to bear for each project.

Our technical staff looks forward to your participation! Please visit our web page for more information.

Special points of interest:

- Over 140 active users established in September 2016
- Over 45 active research projects

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ARSC Staff News

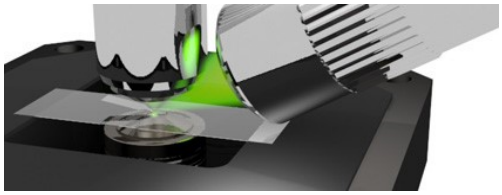
Welcome

Welcome aboard to Dr. Dmitry Lyashenko, Senior Lab Services Technician, who joined our team spring 2016!

Farewell

The ARSC said farewell to Mr. Eric Schires, who has been working for Texas State University for 7 years. Eric has been an invaluable asset to the ARSC and we wish him the best with his future endeavors!

Coming Soon



New Horiba Evolution Raman AFM Microscope coming early spring 2017! Tip-Enhanced Raman Spectroscopy (TERS) brings you the best of both worlds: the chemical specificity of Raman spectroscopy with imaging at spatial resolution typically down to 10 nm. Equipped with AIST SPM system with scanning range 100x100x15 µm. It has an option to operate in liquid and even make electrochemical measurements. Fully integrated High Resolution Confocal Raman Microscope, optimized for VIS-2200 nm, and quipped with 532 nm, 633 nm, and 785 nm lasers.

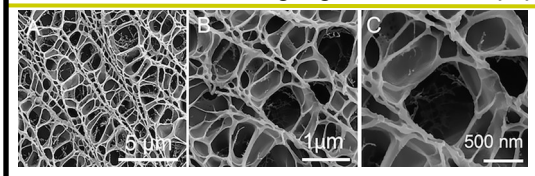
http://www.horiba.com/scientific/products/raman-spectroscopy/raman-afm-and-nano-raman/

Nanofabrication Research Service Center (NRSC)

The NRSC is a 2000 ft^2 multi-user clean room facility that is open to all Texas State University system faculty, research staff, non-resident users for collaboration and students to support their academic and research activities. This facility houses sophisticated equipment in an ultra clean environment where students and researchers can fabricate films, test structures, and devices at the micrometer and nanometer scale.

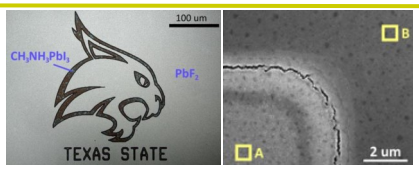
Featured Publications:

Highlighted ARSC equipment enabled research



Dr. Tania Betancourt's research focuses on the development of novel biomaterials that can be utilized for the detection and treatment of cancer and other diseases. Recently, Dr. Betancourt's group reported the preparation of poly(ethylene glycol) hydrogels crosslinked with single stranded DNA as a new type of biomaterial that could be degraded by endonucleases that are known to be overexpressed in cancer, heart disease, and infected wounds. These hydrogels were prepared through copper-free click chemistry. The above figure shows scanning electron microscopy images of the DNA-crosslinked hydrogels (A-C).

Karolyn Barker, et al (2015): Biodegradable DNA-enabled poly(ethylene glycol) hydrogels prepared by copper-free click chemistry, Journal of Biomaterials Science Polymer Edition,



Dr. Alex Zakhidov's research is focused on the comprehensive study of organic semiconductors including: fundamentals, processing, mechanisms and applications in optoelectronics. Organohalide lead perovskite is a novel material with promising applicability for visible light photodetectors. However, a need for high-resolution structuring of the perovskite film to minimize cross-talk between neighboring detectors (pixels) for imaging purposes. This work presents a method to develop perovskite thin films possessing high-resolution patterning, using lithography processing with hydrofluoroether solvents.

Lyashenko, D., Perez, A. and Zakhidov, A. (2016), High-resolution patterning of organohalide lead perovskite pixels for photodetectors using orthogonal photolithography. Phys. Status Solidi A. doi:10.1002/pssa.201600302

Featured Equipment

X-ray Diffraction

The ARSC is proud to announce our **Rigaku SmartLab Intelligent X-ray Diffraction (XRD)** system. The Rigaku SmartLab is a complete XRD system designed for all areas of research whether you are working in thin films, nanomaterials, powders or liquids. The XRD system is perfect for users of all experience levels as SmartLab Guidance provides operators with an intelligent interface that guides a measurement towards best results.

The SmartLab is equipped for high resolution measurements with a full circle goniometer and both incident and receiving monochromators for a maximum resolution (divergence angle) of .0033°. This makes the system ideal for the analysis of nearly single-crystal epitaxial films in rocking curves (RC) or when combined with the 2-dimensional detector for large area techniques such as reciprocal space mapping (RSM). The system can be quickly reconfigured to handle Bragg Brentano geometries for the analysis of composition and phase, or even particle size and composition in transmission geometries such as Small Angle X-ray Scattering (SAXS).

Lastly, the guidance software not only walks users through a measurement, but the XRD comes equipped with a full analysis suite, SmartLab Studio, that guides users through the analysis of their data. SmartLab Studio comes equipped with the extensive ICDD diffraction database, and can even assist in the modelling of materials that are previously unknown.

Electrical Characterization System

Instek LCR-8110G x1

Mode	Measure Range
R, Z, X, Rdc	0.1mΩ ~ 100MΩ
G, Y, B	10nS ~ 1000S
L	0.1nH ~ 100kH
C	0.01pF ~ 1F
D	0.00001 ~ 9.9999
Q	0.1 ~ 9999.9
θ	-180°~ +180°

- Wide Test Frequency 20Hz-10MHz
- 0.1% Basic Accuracy & 6 Digits Measurement Resolution
- 100Ω input impedance

Keithley SMU 2611B x1

- Single channel model with 30W power output
- 4 quadrant source/measure with 6½-digit resolution
- Current Max/Min: 1.5A DC, 10A pulse/ 100fA
- Voltage Max/Min: 200V/ 100nV

Keithley SMU 2450 x3

- V range 20mV-200V
- I range 10nA-1A
- Simultaneous 1MSample/ s voltage and current digitizing

Signatone S-725 Micropositioner x4

- designed for probing targets ~0.5 mil (12.7 microns) and larger
- 80 TPI resolution
- 0.5" X 0.5" scanning area

We're on the Web!

http://www.msec.txstate.edu/Research-Programs/Analysis.html