ELECTRON SPECTRO-MICROSCOPY (ESM) BEAMLINE

BROOKHAVEN NATIONAL LABORATORY

NATIONAL SYNCHROTRON LIGHT SOURCE II

SCIENTIFIC SCOPE

The technical scope of ESM is to prepare a high-flux, high resolving power beam covering the energy range 15–1,500 eV and serving two electron-microscopy end-stations: μ-ARPES and AC- XPEEM. Specific performance parameters for the two beams are:

ARPES	XPEEM
Photon Energy range: 15–1,500 eV	Photon Energy range: 15–1,500 eV
Flux: >10^{10} ph/s @ 100,000 resolving power	Flux: >10^{12} ph/s @ 10,000 resolving power
Resolving Power: ~ 1 meV up to 70 eV photon energy; <30 meV up to 1,000 eV	Resolving Power: same as ARPES branch
Spot Size: <= 1 μm > 60 eV (diffraction limited at lower energies)	Spot Size: ~40 μm
Light Polarization: hor.-lin, vert.-lin, left/right-circular above ~30 eV	Light polarization: hor.-lin, vert.-lin, left/right-circular above ~ 30 eV

BEAMLINE LAYOUT AND EXPERIMENTAL CAPABILITIES

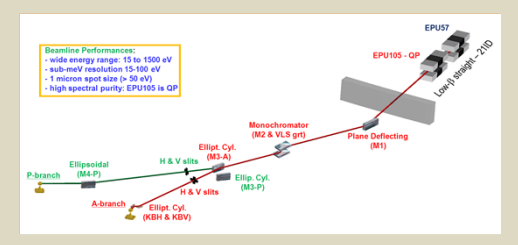
TECHNIQUES:

A-branch

- ARPES, SARPES, μ-ARPES
- XPS, XAS, XMCD

P-branch

- AC-PEEM, AC-LEEM



ENDSTATION DETAILS:

A-branch

- Smaract micro-scanning stage
- Scienta DA30
- Closed cycle LHe cryostats

P-branch

- **Elmitec AC-LEEM III** (Aberration-Corrected Low Energy Electron Microscope)

μ-SARPES

- high resolution (energy and momentum) electronic structure of solids;
- spin-polarized electronic bands of magnetic materials and non-magnetic materials with large spin-orbit interaction;
- scanning spectro-microscopy with 1 mm lateral resolution for chemical maps (core levels) or electronic structure maps (valence electrons)

AC-XPEEM

- energy filtered-XPEEM for chemical maps and (k_x,k_y) band mapping;
- aberration-correction for higher lateral resolution and higher transmission;
- non-destructive, fast-imaging technique allowing simultaneous surface sensitive microscopy and spectroscopy

Overview

PORT: 21-ID

SOURCE: 2 undulators (EPU105, EPU57)

ENERGY RANGE: 15 – 1000 eV

ENERGY RESOLUTION: ΔE/E = 10^{-5}- 10^{-4}

SPATIAL RESOLUTION: 1 μm / 40 μm

CONSTRUCTION PROJECT: NEXT

BEAMLINE STATUS: Construction

AVAILABLE TO USERS: Spring 2017

Beamline Team

STAFF

Elio Vescovo: lead beamline scientist

Andrew Walter: beamline scientist

Yi Zhu: mechanical engineer

Sal Pjerov: designer

Jun Ma: controls engineer

Gary Nintzel: technician

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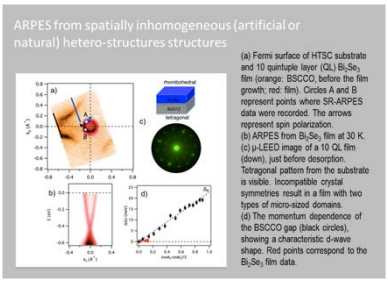
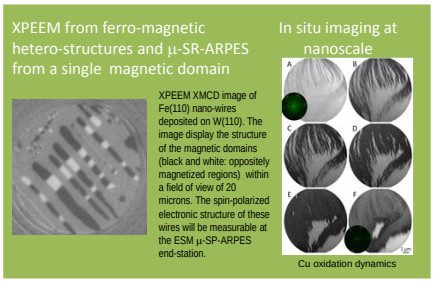
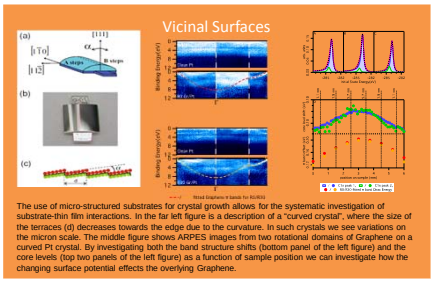
SCIENTIFIC APPLICATIONS







- ARPES from spatially inhomogeneous samples, as well as artificially formed hetero-structures
- ARPES from polycrystalline or micro-crystal materials
- SP-ARPES from inside a magnetic domain
- XPEEM: fast, full-field probe for spatially resolved topographic, structural and spectroscopic measurements
- XPEEM/LEEM: in-situ growth and gas dosing capabilities for real-time investigation of surface processes.