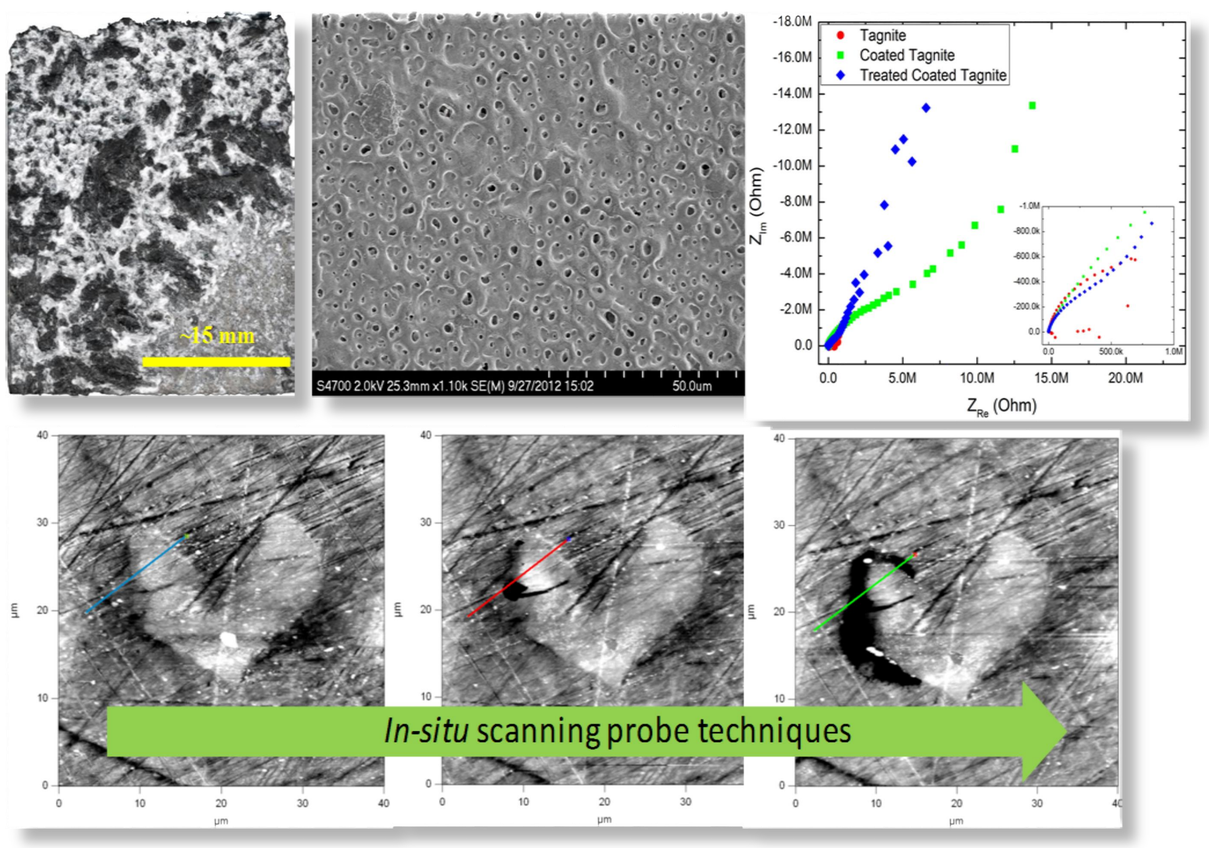
Corrosion Science and Electrochemistry

S&T Campaign: Materials Research
Manufacturing Science
Corrosion & Fatigue

Joseph Labukas
(410) 306-2989
joseph.p.labukas.civ@mail.mil

Research Objective

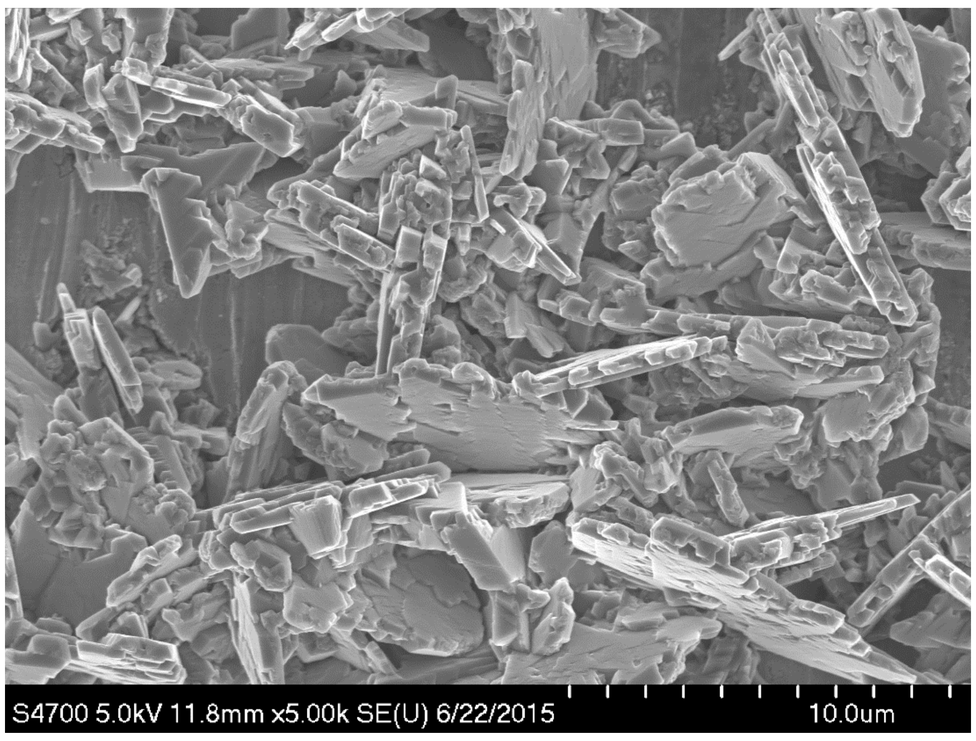
- **To understand fundamental corrosion mechanisms of materials.**
- **By utilizing new techniques at multiple length scales to develop a comprehensive understanding of materials degradation processes, effective mitigation strategies are being developed.**



Bridging length scales with accelerated corrosion, electrochemistry, and in-situ measurement

Challenges

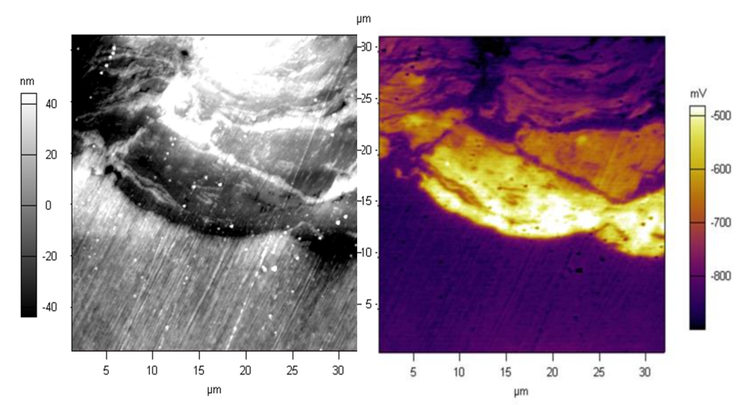
- **"Stainless" High-Strength, Lightweight Magnesium Alloys**
- **<u>ROBUST</u> super-hydrophobic surfaces, active non-toxic corrosion inhibitors (NO Cr^{6+}!)**
- **<u>New techniques</u> for localized chemical and morphological information across surfaces.**
- **<u>Electroplating from Ionic Liquids for corrosion protection.</u>**



Aluminum platelet morphology grown from ionic liquid plating bath

ARL Facilities and Capabilities Available to Support Collaborative Research

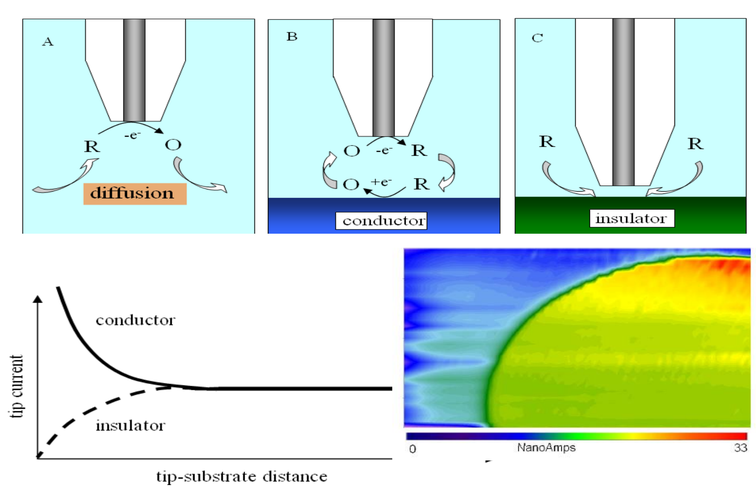
- **World-class scanning probe laboratories**



MFP-3D AND Cypher AFMs with microwave, SKP, photothermal excitation, modulus mapping, and electrical techniques

AFM height (left) and Scanning Kelvin Probe (right) images of Cu surface refined using Fe spheres and SMAT process. Cu substrate shown in lower ½ of image, Fe/Cu interface at top ½

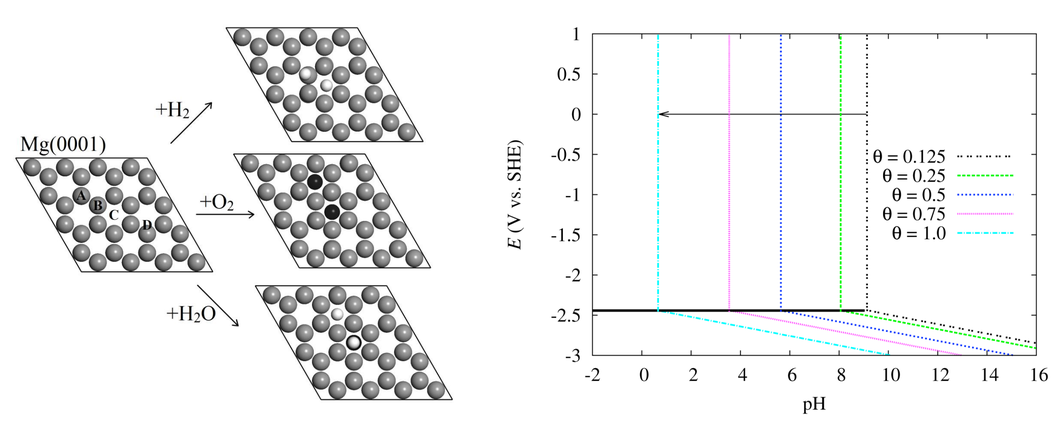
- **Excellent Electrochemical Capabilities**



VersaSTAT 3, 3F, 4, and PARSTAT 4000

Scanning Electrochemical Microscopy (SECM) for surface reactivity and kinetics

- **Multiscale modeling for corrosion and electroplating**



Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- **Plating in ionic liquid environments**
- **Atom Probe Tomography**
- **Expertise in Corrosion Science/AFM/SECM/SVET and electroplating**

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