Microscopy Video Transcript
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Scott Lea
My name is Scott Lea, I'm the Capability Steward for EMSL's Microscopy Group. My expertise is in scanning probe microscopy and the study of interfacial processes at surfaces related to energy and environmental materials.

The purpose of EMSL's Microscopy Capability Group is to provide support to research using high-end electron and scanning probe microscopes. EMSL's Microscopy Capability Group is unique in that it has a collection of instruments that is rivaled by very few laboratories in the world. The instruments we have include transmission electron microscopes, scanning electron microscopes with focused ion beam capabilities, and scanning probe microscopes. In addition, we have the world's first helium ion microscope at a national user facility.

Don Baer
I'm Don Baer. I'm the Lead Interfacial Scientist for EMSL and Chief Science Officer on an interim basis. Many users that come to EMSL are not experts in microscopy and one of the advantages that we have is that our instruments are run by people that are experts. They've done many different types of samples, they're familiar with the instruments we have, they're familiar with conducting and insulating samples, they're familiar with how to prepare them. And that wide range of expertise allows our users to have access to state-of-the-art and world-leading capabilities and the experts in using them in applying these capabilities to their samples and solving their problems.

It's really the integration of microscopy to various other types of techniques that allow us to solve problems that otherwise might not be solved. In many areas including nanotechnology we need a wide range of tools that provide complementary information. Microscopy is really central to some of those, but it's not the only tool we need. And so the real advantage of EMSL is we can relate the microscopy to the many other types of capabilities that we have.

Bernd Kabius
My name is Bernd Kabius and I work at the EMSL in the electron microscope group as a Senior Scientist. EMSL has recently, in the last years, upgraded its equipment for microscopy significantly in order to meet state-of-the-art requirements. This is an ongoing process, which is especially important right now because the last decade has seen more innovation in microscopy than ever before. Right now, these are exciting times to be a microscopist.

One of the key instruments which has been recently installed here at EMSL is a helium ion microscope, a further development of scanning microscope technology. This [instrument] especially allows us to look at radiation-sensitive samples, which is important for biological tissue.

Recently, we have been able to acquire two aberration-corrected instruments. These instruments, because of aberration-correction, will allow us to improve chemical analysis by a factor of ten to one hundred, which enables analysis of single atoms.

Apart from the already mentioned analytical capabilities, we have FIB/SEM opportunities here, which allows us nanofabrication. FIB can be regarded as the knife of the nano-world and allows us not only to fabricate very small things, but also to observe them while they are in operation.

Don Baer
One of the interesting areas where we're using microscopy, in one particular form, this is scanning tunneling microscopy, is to get what we call single-site chemistry. That allows us to understand how a molecule interacts with a specific site on a surface. In some cases we do that with photoexcitation involved. This allows us, for example, to look at photocatalysis. Photocatalysis is important because it's a type of reaction that allows us to split water to produce hydrogen, allows [it] to serve as a catalyst for breaking down contaminants in the environment. So it has major societal implications. We really love to understand exactly where these reactions occur and how we can optimize the catalyst and design it to get the reactions that we want.

Scott Lea
We are looking at lithium ion batteries *in-situ* for the purposes of looking at the micro-structural changes and evolution of the solid-electrolyte interface during charging and discharging cycles of batteries with the purpose of trying to understand how battery failures occur.

We are using the cryoTEM to look at microbes and biofilms in their frozen hydrated state to understand how they can serve as bioremediation agents for cleaning up contaminated soils.