Institute for Shock Physics
APPLIED SCIENCES LABORATORY
Transforming scientific innovations into practical solutions
Winter 2013

Materials Development in the 21st Century

High-performance Alloys for Desired Applications

The development of steel, a high strength alloy, was a catalyst for the industrial revolution at the turn of the 20th Century. Now, the technical needs of the 21st Century demand the design and development of revolutionary materials that move beyond steel and possess greater strength and multi-functional properties.

Dr. Atakan Peker, a pioneer in the field of materials science, is developing a new class of alloys with material properties tailored to specific applications. These alloys have an amorphous structure (similar to glass) that differs from the crystalline structure of conventional alloys (such as steel or titanium). Called "bulk metallic glass", these alloys have a random atomic structure and exhibit significantly higher strength than conventional alloys. In addition, they also have desirable functional properties, such as corrosion resistance and near net-shape formability.

The Defense Threat Reduction Agency (DTRA) has funded Dr. Peker to perform research on optimizing the ratio of toughness to strength of these high-performance alloys. Just as a race car needs better brakes to stop, bulk metallic glasses need higher toughness (e.g. the ability to bend without breaking) to fully utilize their ultra-high strength and move beyond the current state of steel alloys. Through alloy formulation, composite processing and microstructural design, Dr. Peker and his team have made significant progress in improving the toughness of these new alloys. Ultimately, this material has the potential to replace steel in many applications and to introduce cost savings into products, such as a reduction of machining time and material waste, as well as corrosion resistance.

Events

ASL Spring Breakfast Meeting
What's New at ASL?

This Spring, ASL will host a Breakfast Meeting to provide an update on research projects, breakthroughs, and new areas of expertise. If you would like to be added to the breakfast guest list, please contact Robin Durfee at 509-358-7700 or asl@wsu.edu.

Fall Breakfast Meeting Recap

A standing room only group of community and business leaders attended the ASL Breakfast Meeting on November 1, 2012. Dave Holmes, formerly of Avista, presented an update on the ASL and Avista partnership to develop eco-friendly hydraulic fluids to meet Avista's environmental and performance needs. Dr. Santanu Chaudhuri described computational methods for designing state-of-the-art paints and coatings for the aerospace industry that optimize deicing and prevent corrosion. Lastly, Dr. Parijat Sengupta introduced her innovative biomedical research using a "brain in a dish" to study solutions for memory disorders and traumatic brain injury.

We hope to see you at the ASL Breakfast Meeting in the Spring!

Research and Development

ASL and Triumph Partnership - Growing R&D for the Aerospace Industry

Companies that maintain a tenacious Research & Development (R&D) strategy create a stronger, more positive future for their industry. ASL provides an effective approach for companies to reinforce their R&D strategy.

ASL is currently working with Triumph Composite Systems, an aerospace industry leader, to improve the processing conditions for compression molding laminates made from composite materials. Under standard heating and cooling conditions, temperature changes in the composites result in stresses that can lead to out-of-specification dimensions. ASL is working with Triumph to solve the problem of dimensional instability in the heating and cooling process, which will lead to a greater yield of usable composite parts and the ability to reprocess out-of-specification parts.

"As a company that is currently trying to grow their existing R&D capabilities, Triumph has found that utilization of ASL's staff and resources has been a great way to augment our immediate needs as we expand our own capabilities. Our working relationship with ASL has been very positive thus far and we look forward to the opportunities our future joint efforts have to offer."

Wade Bowles, Director of Engineering, Triumph Composite Systems

Visiting ASL

ASL is conveniently located! Martin Luther King Jr. Way connects downtown Spokane and the WSU Riverpoint campus, creating easy access to our labs. ASL is located on the second floor of the Spokane Technology Center Building at 120 North Pine, between Main and Martin Luther King Jr. Way.

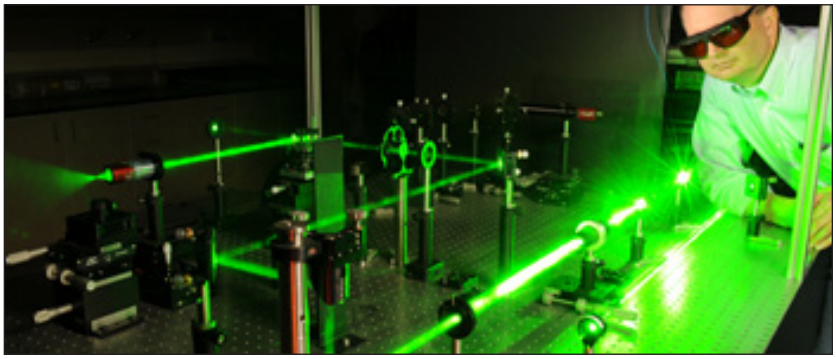
To schedule a personalized visit and take a tour of our unique research facilities at ASL, contact Robin Durfee at 509-358-7700 or asl@wsu.edu.

New Projects

ASL scientists, Drs. Santanu Chaudhuri and Hergen Eilers, were recently awarded new grants to conduct national security related research. Both projects will contribute insight into the design of new materials with modifiable properties to increase the safety and predictability of current energetic materials.

Multiscale Modeling

With support from the Defense Threat Reduction Agency (DTRA), Dr. Chaudhuri is leading a project aimed at developing a new material design approach for reactive nanoscale composites. The research is geared towards the development of novel multi-scale computational design methods for identifying optimal chemical formulations to enhance safety and deliver customized performance. This three-year project utilizes the high-peformance computing facility at ASL.



Lasers, Gas, and Molecules

ASL is also using experimental methods to explore properties of energetic materials. Dr. Eilers and his team are using optical techniques to observe materials in action. While conducting laser spectroscopy experiments on large molecules in argon gas, Dr. Eilers noticed that these molecules break apart when the laser light interacted with them. The Office of Naval Research (ONR) is now funding this research to determine the amount of kinetic energy release in a variety of gas mixtures. This three-year project utilizes the optical sciences capabilities at ASL.

New Faces

(l to r). Shahryar Fotovati, Ph.D., Robin Durfee, Justin Archer, Boris Averkiev, Ph.D.

ADMINISTRATION

Robin Durfee recently joined ASL as the Administrative Coordinator. Robin grew up in Pullman, WA and returned to the region after more than 30 years in San Francisco, CA. She is looking forward to working with the Spokane community to engage their participation in ASL research and development activities.

ENGINEERS

Justin Archer, Operations Engineer, joined ASL in January. His work is focused on materials processing and the fabrication of bulk metallic glasses. Justin holds a B.S. in Mechanical Engineering from the University of Idaho.

POST DOCTORAL RESEARCH FELLOWS

Dr. Boris Averkiev recently joined Dr. Chaudhuri's Research Group. Dr. Averkiev performs quantum chemistry calculations and develops multi-scale computational methods. He has a Ph.D. in Chemistry and Biochemistry from Utah State University.

Dr. Shahryar Fotovati, also joined Dr. Chaudhuri's Research Group. Dr. Fotovati's focus is on computational fluid dynamics, aerodynamics, and multi-scale modeling. He has a Ph.D. in Mechanical and Nuclear Engineering from Virginia Commonwealth University.

What ASL Can Do For You

Scanning Electron Microscope (SEM)

Examining Surfaces and Substances for Spokane Businesses

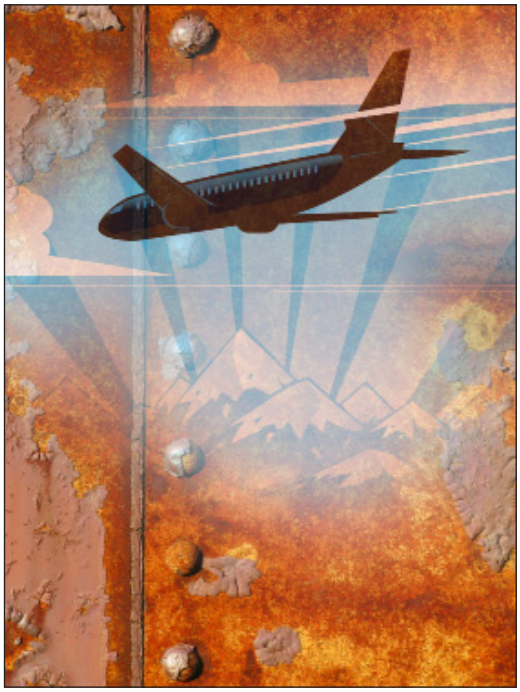
A scanning electron microscope (SEM) is a microscope that produces images of a sample by scanning it with a focused beam of electrons instead of light as in a conventional optical microscope. The SEM electrons interact with electrons in the sample, producing various signals that can be detected and contain information about the sample's surface topography and composition. SEM can achieve resolution better than 1 nanometer!

From materials analysis and failure investigation to providing an elemental map of metal alloys or surface composition, ASL research scientist and engineers can utilize the SEM to enhance your products.

Hematite in a Scanning Electron Microscope, Magnification 100X (Wikipedia)

"Using SEM/EDS Materials Characterization, ASL assisted ReliOn Inc. in investigating field failures of high pressure flexible stainless steel hoses, leading to successful discussions and problem resolution with the component supplier."

Bill Fugelvand, ReliOn, Inc.



Salt Fog Chamber

Accelerated Testing to Prevent Corrosion

This time of year, we dream of coastal beaches, foggy mornings and salt-water waves. At ASL, salt fog exposure is an environmental test that we offer to our customers.

Using a Salt Fog Chamber to simulate extreme environments, ASL can conduct cost effective corrosion testing for local industries. These tests help avoid lengthy and costly outdoor atmospheric tests. Salt fog spray testing can be conducted on protective coatings, inorganic and organic coatings or directly on a metallic substrate. These tests help determine the effectiveness of protective coatings and finishes on materials. Running these tests can also help answer how salt deposits impact the physical and electrical components of a product.

Newsletter - Winter 2013

ISP/Applied Sciences Laboratory
Washington State University
120 North Pine, Spokane, WA 99210-1495
509-358-7700, www.asl.wsu.edu