Battelle **Surface Science**

BRINGING INNOVATION TO THE SURFACE

What happens when you bring the latest materials science discoveries and product engineering excellence together?

At Battelle, we're bringing new innovation to the science of surfaces, coatings and interfaces to solve your most challenging product problems.

Battelle's Surface Science is an engineering and development service focused on creating novel solutions to improve product performance and make entirely new products possible. From antimicrobial surfaces to spray-on conductive coatings, we develop functionalized surfaces that are specifically targeted to each client's needs. We can help you break through the barriers standing between you and your product vision and develop products that outperform the competition. With Battelle's Surface Science, you can:

- Expand your product portfolio and develop new IP
- Differentiate your products with unique functionality and higher performance
- Accelerate your product development timelines.

THE POWER OF SURFACE SCIENCE

What do we mean by a functionalized surface? Simply put, it's a surface or coating that has been engineered to interact with its environment in response to defined triggers. Imagine:

- An antimicrobial surface that uses nanostructures to prevent bacterial adhesion
- A conductive coating that provides controlled heat when electricity is applied
- A food-safe adhesive that sticks only to itself
- A fabric coating that neutralizes toxins and carcinogens
- A stain-repellant laundry additive that won't wash out in the rinse cycle.

Functionalized surfaces can be developed to solve all kinds of problems for medical, commercial and industrial applications. If you can imagine it, we'll help you find a way.

A FASTER WAY TO MARKET

We use proven, systematic, phased processes to accelerate development timelines and ensure that final results fully meet your requirements. Our multi-disciplinary teams draw from expertise across Battelle, including advanced materials, engineering, chemistry, biochemistry, product formulation and more. With over 22,000 employees at more than 60 locations globally, we resource specialists from practically any field needed to solve your problem efficiently and effectively.

At Battelle, our teams are focused on developing products for commercialization. We understand market needs and manufacturing realities, and we can work with you at all stages of development, from product ideation to ramp up to manufacturing.

AT BATTELLE, YOU'LL FIND:

- Unmatched experience with non-traditional surface interfaces and unusual surface interactions
- Expertise across a broad range of disciplines and industries
- A focus on commercial viability and market needs.

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A Chemical Agent Resistant Coating that Sheds and Decontaminates

Chemical Agent Resistant Coatings (CARCs) are used to protect infrastructure, vehicles and equipment from chemical agents such as mustard gas and nerve agents (saran or VX) in combat zones. CARCs slow the absorption of chemical agents into the coating, protecting the material underneath and buying time for decontamination. However, if agents are absorbed, decontamination can be both time-consuming and expensive. Battelle has developed a new smart coating that sheds and decontaminates chemical agents to better protect infrastructure and combat equipment. The hydrophobic coating sheds chemical agents in the field so they are not absorbed. A functional silica group actively decontaminates the surface by reacting with any remaining traces of chemical agent and breaking it down into harmless compounds. The new CARC has the potential to significantly reduce decontamination costs for the military.

Conductive Gel Improves Performance of EKGs without Skin Abrasion

Changes in electric potential and impedance of human skin can cause significant errors in biopotential measurements such as electrocardiograms (EKGs) and electroencephalograms (EEGs). Light abrasion of the skin is commonly used to improve performance. Improving ionic transport between the electrode and the body could eliminate the need for preparatory skin abrasion. Battelle researchers developed a gel mixture to improve ion transport across the stratum corneum (the outer layer of skin). The gel demonstrates high levels of performance for biopotential measurement without skin abrasion, with fast response and long-lasting connection. It uses commonly available, generally recognized as safe (GRAS) materials and can be added to the surface of the electrode during manufacturing, allowing hospital technicians to simply peel and stick the electrode to exposed skin without preparatory abrasion.

Light-conducting Separator that Improves Battery Safety

Lithium ion (Li-Ion) batteries used in laptops, electric vehicles and aviation can develop internal flaws called dendrites (small tendrils of metal that grow off of one of the electrodes). If a dendrite breaks through the plastic separator that keeps the electrodes apart, it causes a short circuit, potentially leading to fires or explosions. Battelle researchers developed a concept for an optical sensor to monitor the battery for internal flaws such as dendrites. However, in order to make it work, they needed a separator that could conduct light as well as ions. We identified a polymer that would allow sufficient light through for the optical sensors and still provide physical separation and ion transfer between the electrodes. In order to optimize performance, we also changed the formulation of the electrolyte in the battery.

New Plastics Offer Effective Thermal Transport and Heat Spreading

Heat buildup is a significant problem and limiting design factor for many electronic products. Heat-sink materials for LEDs and other electronics are often made of metal such as aluminum. However, these metal components add significant weight and other design limitations. Thermally conductive plastics offer an opportunity to design functional parts with heat management capabilities while eliminating many of the negative features of metallic heat sink materials. Battelle has developed thermally conductive thermoplastic materials for complex net shape geometries, as well as spray-on, conformal, thermally conductive coatings for efficient heat spreading over large areas. The new thermoplastic materials can be up to 40% lighter than conventional metal components and can be easily designed to meet a wide range of product requirements.

New Process Solves Adhesion Failure for a Medical Device

A medical device manufacturer released a medical instrument that joined glass and polyether ether ketone (PEEK) components using a cured epoxy. The adhesive performed well in product validation testing, but not under actual use conditions, resulting in separation of the glass and PEEK components. Battelle researchers first looked at how the customer uses the product, and how variables such as heat, humidity, cycling load and user behaviors interact, to develop a new validation process for testing alternative adhesion methods. We identified an atmospheric plasma treatment to be applied to the PEEK component. The new process resulted in better adhesion for the device components, reducing field failures and repair costs and rebuilding brand reliability. The treatment was also easy to integrate into their manufacturing process and did not require changes to product design or material selection.

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It can be done