SNAP SHOTS

Phosphor films provide benefit to hypersonic weaponry

Photo by John Williams, Office of Naval Research

Electromagnetic launchers, or railguns, push projectiles at hypersonic velocities.

For nearly two decades, the U.S. Navy has been researching and testing the use of electromagnetic launchers, or railguns, for potential use on future naval warships. These futuristic weapon systems use a powerful pulse of DC electric current passing through a moving armature between two current-conducting metal rails. The resulting electromagnetic forces push the armature, and the projectile loaded in front of it, to velocities as fast as Mach 10.

Propelled at such speed, the hypervelocity projectiles (HVP) would not even need an explosive warhead, as the kinetic energy alone could make a relatively small solid metal projectile pass through an entire ship, with devastating results. The idea that a future "electric warship's" guns could have much greater range, without having any dangerous explosives to handle, has made railguns an attractive future military technology, and several powerful demonstrators have been built and tested.

Not surprisingly, the development of such a powerful weapon system has required the development of new sensor technology to evaluate its performance in a harsh, high-voltage environment. Responding to a Navy Small Businness Innovation Research (SBIR) topic, PhosphorTech of Kennesaw, Georgia, proposed to develop a new sensor based on a phosphor film which could be used to read temperatures up to 700 degrees Celsius. The sensor could be read remotely using a laser, so no wires or devices that would interfere with the electromagnetic launch environment were needed.

By placing a phosphor film on the launcher or on a probe attached to it, engineers could point a laser at the film from afar. Because characteristics of the emitted light (for example, brightness and color) change with temperature, the method could be used as a remote sensing technology for the harsh environment of electromagnetic launchers, where traditional thermocouples have a very slow response and cannot be used to provide reliable temperature data under high speed conditions.

The phosphor film was further developed through several Department of Energy (DoE) SBIRs, resulting in a patented flexible phosphor film for solid-state lighting and display applications. It employs a roll-based coating process to achieve greater performance in LED lighting while also using less phosphor material. The flexible phosphor film technology was also used in the development of a novel infrared scene projector under an Army Small Business Technology Transfer (STTR) project, jointly with the Georgia Tech Research Institute.

Phosphor Tech Corp.

Modernization Priority: Hypersonics

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