



A Novel Approach for Anti-Tamper

BACKGROUND

Anti-Tamper (AT) is a methodology to deny access to electronic systems (or components) by foreign or unfriendly agencies; generally speaking these foreign agencies attempt to reverse-engineer systems that are lost during operation or training use. One possible example is the use of training torpedoes, it is possible that a torpedo could inadvertently be lost or unrecoverable during a Naval exercise. A hostile agency could potentially recover the torpedo, gain access to its internal systems, reverse engineer how it works, and develop countermeasures to defeat the weapon; in future conflicts the weapon could be rendered less effective or even useless thereby degrading the overall effectiveness of our Naval forces.

Electrically Controlled Solid Propellant (ECSP) is a chemical compound that is inert until an electric field is applied, upon which combustion can be initiated. Accordingly, it is possible to apply a layer of the material to "sensitive electronics" to achieve an anti-tamper boundary; if the boundary is not violated the propellant is inert, if the boundary is violated the compound is manifested and the circuit card destroyed. This propellant chemistry is more stable than other propellants (such as Ammonium Perchlorate Composite Propellant (APCP)), inert (until electrified), and environmentally benign, thus making it a good candidate for AT applications.

DISCUSSION

Under Missile Defense Agency (MDA) funding, Digital Solid State Propulsion, LLC, developed a new class of solid propellant chemistry that is environmentally friendly, insensitive, and with the added benefit that it can be "throttled" (the rate of reaction increased or decreased). By itself the propellant is inert; when fitted with electrodes and an electric field applied, the propellant can be ignited and will continue to burn until the voltage is removed, causing extinguishment. Once extinguished, the electrically controlled propellant can then be re-ignited electrically at will. The propellant's rate of combustion can be changed by up to 10x by altering the electrical power input. Electrically Controlled Solid Propellants (ECSPs) are insensitive to ignition by spark and flame and are therefore safer to transport, store, and use than other propellant chemistries. Baseline ECSP formulations are non-toxic and primary combustion byproducts – CO₂, N₂, and H₂O – are benign when compared to other propellant chemistries. The primary benefit of this technology would be the ability to safely apply a layer to circuit card assemblies (CCAs) that is inert until needed, upon which an energetic reaction will destroy the CCA.

CONCLUSION

- Implementation of ECSP could provide another avenue to ensure AT compliance



RECOMMENDATION

- Anti-Tamper Program offices should consider pursuing development project (or potentially teaming with current US Navy/Department of Defense projects) to exploit this new family of chemical compounds in order to provide new AT capability. In this case, WILLCOR was able to identify novel uses for a recently developed technology. Digital Solid State Propulsion LLC was funded through the Missile Defense Agency to develop an propellant able to be electrically throttled. Because WILLCOR has performed work for many different agencies and DoD organizations, we are able to identify opportunities for novel applications for technologies.

If you have a technology and would like to see what applications may be a good fit, or if you would like assistance in transitioning to production, please contact Brian Willoughby at brian@willcor.com for more information.