



CRANE

Method of Increasing the Surface Hardness of a Fragmentation Device

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Categories:

- Materials and Manufacturing
- NSWC Crane

Keywords:

- Crane
- Materials and Manufacturing
- Surface Functionalization
- Surface Patterning
- Surface Treatment

In the past, materials used for devices that fragment, such as grenades or shells, has been ductile and may not rupture uniformly at designed fracture location. Additionally, when the explosive is ignited, the ductility of the material may result in only a partial fragmentation. This has led to devices that fragment into a few larger pieces rather than small sections as intended and for the remaining pieces to be plastically deformed instead of fractured.

Naval Surface Warfare Center, Crane Division (NSWC Crane) has patented a method of modifying the properties of the surface of the device intended to fracture. The modification includes positioning the fragmentation device within a carbon-rich environment, increasing the temperature to 1,200 degrees Celsius, and absorbing carbon into the outer surfaces of the device. This leads to an increased carbon content of the outer surfaces to 0.06 wt. % carbon to 1.0 wt. % carbon and maintaining an original carbon content of 0.01 wt. % to 0.05 wt. % carbon in the interior sections. The increased carbon content in the outer layers of the device causes the material to be more brittle and less ductile leading to smaller fragments during ignition of an explosive.

Advantages

- Small fragments
- Easier to control the size and number of fragments resulting from a device
- Better able to predict and model the shape and pattern of fragmentation

Potential Applications

- Condensed matter applications
- Materials and fracture mechanics
- Ceramics
- Armaments
- Mining and manufacturing

People:

- Scheid, Eric (Project leader)
- Deshpande, Nishkamraj U
- Schwabe, James E

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Contact OTC:

Purdue Office of Technology Commercialization
The Convergence Center
101 Foundry Drive, Suite 2500
West Lafayette, IN 47906

Phone: (765) 588-3475

Fax: (765) 463-3486

Email: otcip@prf.org