

SERDP PROJECT OF THE YEAR

WEAPONS SYSTEMS AND PLATFORMS

DEVELOPMENT OF CHROME-FREE WELDING CONSUMABLES FOR STAINLESS STEELS

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Department of Defense personnel perform a significant amount of welding for the fabrication and repair of stainless steel parts and structures in thousands of ships and tanks. In many cases, this welding must be conducted in confined spaces. Welding fumes generated using conventional stainless steel welding rods, or consumables, are particularly harmful because they contain hexavalent chromium. The ability to control and capture these fumes is difficult, and the common method of protecting workers by putting them in cumbersome protective gear is impractical in these cramped settings.

Rather than developing a new control technology, Dr. Gerald Frankel and his team designed a novel chromium-free welding consumable that provides the same strength and corrosion protection as the conventional weld. Prior SERDP exploratory development research identified a welding consumable composition of nickel, copper, and palladium as a potential replacement for chromium-bearing stainless steel. This follow-on project developed a chromium-free welding consumable compatible with common 300-series base metals such as Types 304 and 316. To ensure that the consumable met or exceeded the properties of existing consumables, numerous corrosion, mechanical property, and weldability tests were conducted.

A recent reduction in the Permissible Exposure Limit (PEL) for hexavalent chromium in welding fumes has the potential to severely restrict current welding operations. The chromium-free welding consumable for stainless steels developed by Dr. Frankel will allow the new PEL to be met using conventional welding processes currently used in many DoD industries. This new consumable significantly reduces hexavalent chromium and manganese emissions, while meeting the mechanical and corrosion properties of the current consumables used to weld stainless steels. In doing so, it protects the workforce that repairs ships and tanks and also minimizes costly monitoring and mitigation measures.

For more specific information about this project, stop by Poster #25.