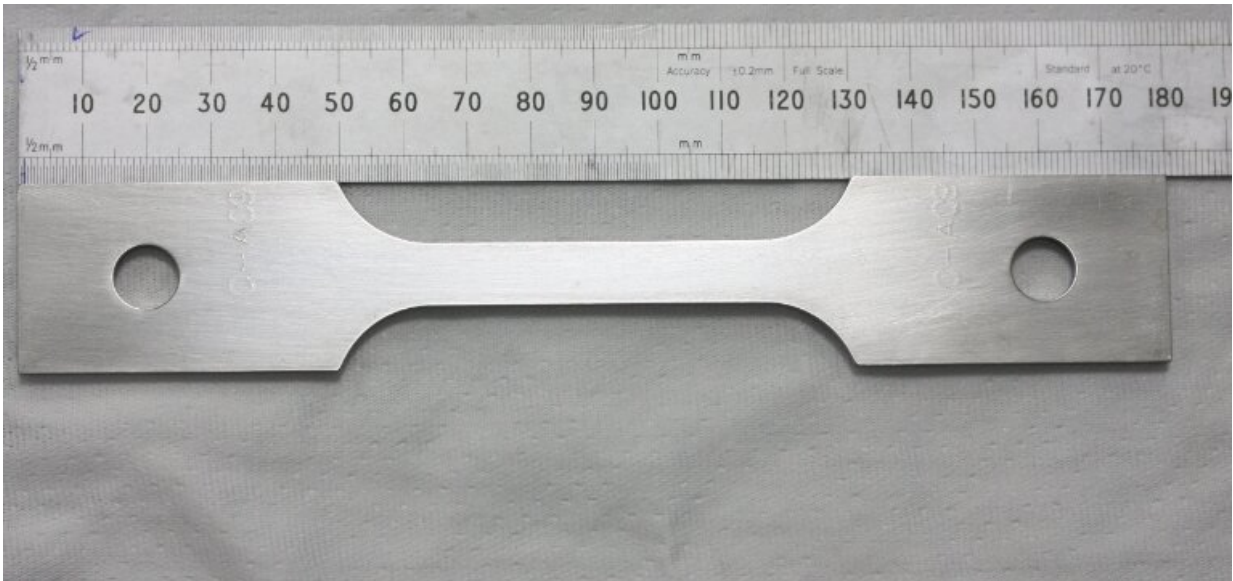


# Can citric acid be a green alternative to protecting steel?

September 26 2019

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Citric acid as green alternative for metal protectant. Credit: European Space Agency

Nitric acid is currently the most widely used passivating solution to protect stainless steel from corrosion in industrial applications. But nitric acid is dangerous in multiple environmental, safety, and processes, due to its highly acidic nature and the toxic fumes, greenhouse gases and hazardous waste it generates. Citric acid is a promising replacement as it can be produced from natural sources, requires lower acid concentrations and doesn't generate toxic fumes or hazardous waste.

Until now, citric acid has rarely been used in space, and so its performance has not been fully demonstrated.

A TDE activity (T724-403QT) with ESR Technology in the UK wanted to evaluate the suitability of a citric acid process for replacing health hazardous nitric acid processes used for passivating typical stainless steel grades used in spacecraft and ground support structures.

To assess the suitability of citric acid, three stainless steel grades, made from various metallurgical types (austenitic, precipitation-hardened and martensitic) were studied in both welded and non-welded conditions.

Extensive testing (chemical composition, corrosion resistance, and [mechanical properties](#)) of the specimens was performed and compared with specimens passivated with [nitric acid](#).

The results of this activity demonstrated equal or better performance in corrosion resistance and mechanical properties for [stainless steel](#) specimens passivated with the more environmentally friendly [citric acid](#) process.

The activities success has led to a follow-up activity being included in the GSTP Clean Space compendium.

Provided by European Space Agency

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