CURF
Clemson University Research Foundation

Methodology for Stabilization and Preservation of Iron Artifacts (04-026)

Subcritical solution efficiently extracts corrosive salts from corroded metals to mitigate damage to historical iron artifacts

Market Overview

Rust formation on marine archaeological artifacts is a commonly occurring problem. When these artifacts are recovered from a saltwater environment, the high concentration of chloride ions (Cl-) rapidly oxidizes the metal in the presence of highly-oxygenated air. Placing artifacts in solution, even that similar to the conditions from which artifacts were recovered, will not guarantee long-term cessation of the oxidation process. Conventional treatment for corroded cast and wrought iron is a time-intensive operation that often takes many months or even years, requiring large amounts of chemicals and producing high quantities of waste. Clemson University researchers have developed a technique that utilizes an alkaline solution held at subcritical temperature and pressure to rapidly remove chloride ions from corroded iron, reducing the length of the artifact conservation process.

Application

Iron conservation, Maritime artifacts

Stage of Development

Validated Prototype

Advantages

- Drastically increases chloride ion removal rate, reducing time needed for the conservation process
- Avoids partial or total disassembly that may be necessary for conventional methods, maintaining structural integrity of the artifact
- Scalable process can be performed in a clear tank, allowing artifacts of varying sizes to be displayed throughout the operation

Technical Summary

This approach uses a solution of water and sodium hydroxide to rapidly remove chloride ions from iron artifacts. The solution is held at subcritical temperature and pressure conditions to optimize the properties of water for chloride removal. As a result of these conditions the viscosity of water is diminished, which improves penetration into the artifact's interstices. The decrease in water density enhances fluid transport into pores and the raised temperature heightens chloride diffusion constants, further speeding up the process. Using this method, researchers were able to quickly remove chloride ions in order to stabilize archaeological iron artifacts previously submerged for over 130 years and help prevent their future corrosion.

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App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Continuation Provisional	United States	13/330,104 60/664,083	8,535,447	04-026	Michael Drews

For More Information

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