

A Method to Electropolish Internal Surfaces of 3D-Printed Metal Components

PHYSICAL SCIENCES: Manufacturing and Production

The Challenge

3D printing has enabled the facile production of metal components with complex geometries and features that would otherwise be inaccessible through conventional manufacturing methods. However, one major drawback of using 3D printing methods is the surface roughness of these components. While smoothing methods are known for external surfaces, it is much harder to polish the internal surfaces. Therefore, the key challenge lies in developing a simple and cost-effective method of smoothing internal surfaces of 3D-printed metal components.

The Solution

Researchers at Monash University have developed a highly-effective method for electropolishing internal surfaces of 3D-printed components through co-printing a porous low-density internal electrode alongside the main component. This allows the electrode and component to be made of the same metal, ensures that the electrode conforms to complex internal surfaces, and provides a mechanical connection between the electrode and component. Once the electropolishing process is completed, the electrode can then be easily removed from the component without leaving behind any residue.

Key Benefits

- Applicable to a range of metals and internal geometries.
- Provides a quick and simple process to reduce internal surface roughness
- Improves electrochemical properties and pitting resistance
- Electrode can be easily removed without leaving residue

Development Stage

TRL5 Validation

Brief Description & Differentiation

In order to tackle the challenge of improving the finish of internal surfaces in 3D-printed metal components, the researchers determined that an internal electrode could be co-printed alongside the metal body.

This built-in electrode is designed with a lattice structure, resulting in a high surface area, low density cathode that conforms to the shape and dimensions of the internal cavity. Flowing the electropolishing solution through this component leads to thorough and homogenous electropolishing of the internal cavity, achieving an 85% surface roughness reduction in only 5 minutes.

By ensuring that the internal electrode is mechanically weaker than the main component, this cathode can be removed after the process is completed without leaving residue.

Research Team

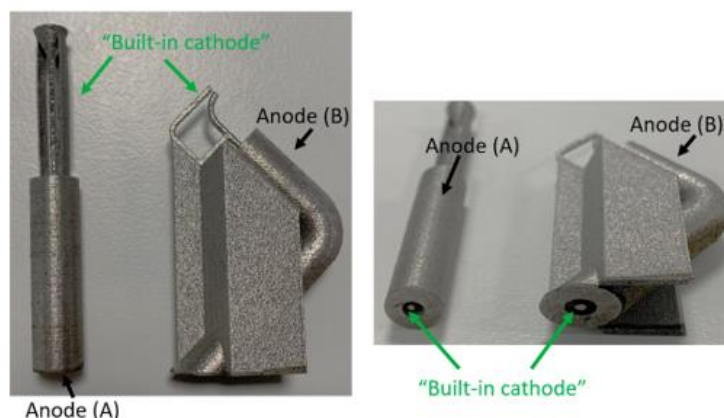
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Intellectual Property

Australian Provisional Patent application filed (2023904055).

Key Publications

Manuscript in preparation.



Above: 3D-printed prototypes containing a built-in cathode.

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