

# Grain Structure of Stainless Steel for Anti-Wetting Properties

---

**A fabrication technique involving anti-wetting properties to stainless steel without applying a coating, while maintaining stability of the material**

Georgia Tech inventors have developed a novel fabrication technique to impart anti-wetting properties to stainless steel without applying a coating, while still maintaining the integrity of the mechanical and thermal stability of the material. The process is a two-step electrochemical etching process comprised of sequentially low and high anodic potentials, resulting in the evolution of intrinsic hierarchical structures that impart enhanced anti-wetting properties to the stainless steel. Using dilute nitric acid as the electrolyte, the potentiostatic electrochemical etching is carried out at a low anodic potential to evolve intrinsic grain structures. A second step of potentiostatic etching step is performed at high anodic potential. The resulting surface shows a hierarchical structure composed of microscale intrinsic grains and enhanced nanoscale surface roughness. Further improvement in anti-wetting properties can be achieved through the application of a thin-film fluoropolymer layer resulting in a  $160^\circ$  static contact angle and roll-off angle of less than  $20^\circ$ .

## Summary Bullets

- Utilizes intrinsic grain structures of stainless steel to modify surface wettability
- More efficient fluid transport and reduced energy consumption
- Does not require the deposition of additional coatings

## Solution Advantages

- Utilizes intrinsic grain structures of stainless steel to modify surface wettability
- More efficient fluid transport and reduced energy consumption
- Does not require the deposition of additional coatings
- Maintains mechanical and thermal stability of the stainless steel.
- 2-step process occurring at room temperature.
- Enhanced heat transfer efficiency

## Potential Commercial Applications

- Commercial, industrial and military applications
- Antifouling coatings and reduced drag on ship hulls

- Power generation and desalination processes
- To create appliances and fixtures that are easier to keep clean

## Background and More Information

Stainless steel is an essential material in a variety of industries. It has superior corrosion resistance while retaining high mechanical strength. Understanding and controlling the wettability of stainless steel has significant value in imparting anti-fouling properties on surfaces, enhancing fluid transport, and facilitating surface cleaning.

## Inventors

- Dr. Won Choi  
Graduate Research Assistant - Georgia Tech School of Chemical and Biomolecular Engineering
- Dr. Laurens Breedveld  
Associate Chair for Undergraduate Studies, Associate Professor and Frank Dennis Faculty Fellow - Georgia Tech School of Chemical and Biomolecular Engineering
- Dr. Dennis Hess  
Professor and Thomas C. DeLoach, Jr. Chair - Georgia Tech School of Chemical and Biomolecular Engineering
- Dr. Kkochnim Oh  
Post-Doc Fellow - Georgia Tech School of Materials Science and Engineering
- Dr. Preet Singh  
Professor and Associate Chair of Graduate Studies - Georgia Tech School of Materials Science and Engineering

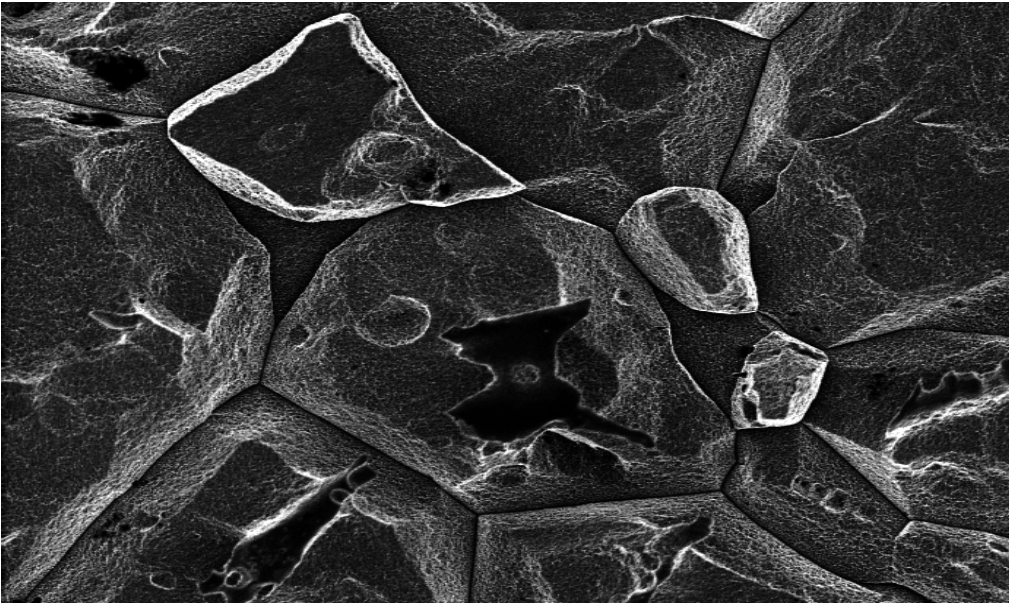
## IP Status

: US10458037B2

## Publications

, -

## Images



Visit the Technology here:

[Grain Structure of Stainless Steel for Anti-Wetting Properties](https://s3.sandbox.research.gatech.edu//print/pdf/node/3793)

---

<https://s3.sandbox.research.gatech.edu//print/pdf/node/3793>