Devon Baker

Materials Science and Engineering, Virginia Tech
Accelerated UG/G Program, Honors Student

“Understanding the Corrosion Resistance of Cast Nickel Alloy C276 through Control of Heat Treatment”

Abstract:

Nickel Alloy C276 (UNS N10276) is commonly used as pipes in the sulfur scrubbers of coal-fired power plants. Coal frequently contains sulfur impurities, which react upon combustion to form SO₂ and SO₃. EPA regulations limit the amount of these compounds that can be emitted from coal-fired power plants, so sulfur scrubbers are used to remove the pollutants by reacting them with water to form sulfuric acid, which can then be dealt with separately. The pipes in these sulfur scrubbers are therefore exposed to both gaseous and liquid sulfuric acid at low temperatures (<300°F), necessitating the use of corrosion-resistant alloys for this application. Nickel Alloy C276 is typically used as forgings, so an investigation of the properties of a cast version of the alloy was performed in order to compare its viability to that of forged C276.

The biggest factor that controls the corrosion behavior of Nickel Alloy C276 is the microstructure. There are two main options for changing the microstructure of cast alloys, chemical composition and heat treatment. This thesis focuses on the effect of heat treatment on microstructure and corrosion behavior of Nickel Alloy C276. Temperature, holding time, and cooling rate were varied across different heat treatments in order to see their effect on the microstructure and corrosion behavior of the cast samples. Microstructure was characterized through SEM and EDS analysis, and uniform corrosion rates were found through mass loss, as per ASTM/NACE G31.

Biosketch

Devon Baker is a senior Honors student in the Department of Materials Science and Engineering at Virginia Tech. He will graduate this May with an in-Honors B.S. in Materials Science and Engineering, with a strong focus on metallurgy and metal casting. He will be an M.S. student in MSE at Virginia Tech starting this fall, under the advisement of Dr. Alan Druschitz, with research interests in metallurgy, metal casting, heat treatment, and corrosion behavior.