EXTENDING AUTOCLAVE SERVICE LIFE BEYOND THE THIRD DECADE

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ABSTRACT

Autoclaves are critical fixed assets integral to the high-pressure acid leaching (HPAL) process. Traditionally, these vessels are engineered with a thirty-year operational lifespan, aligning with the projected lifespan of mining operations. Throughout this designated lifespan, regular maintenance efforts are directed toward repairing corrosion and erosion damage within the autoclave lining. However, a critical knowledge gap exists regarding the viability of extending the autoclave's service life beyond its designed duration.

Despite the initial design parameters, instances arise where the operational lifespan of an autoclave needs to be prolonged, particularly when the mine's lifespan is extended. Comprising formed carbon steel and explosion-bonded titanium, the autoclave's structure blends mechanical strength with cost-effectiveness. The titanium-clad lining is a vital protective layer, shielding the vessel's interior against high-temperature acidic slurry's corrosive and erosion effects.

Given the considerable size of autoclaves, their construction entails multiple plates of carbon steel and explosion-bonded titanium, meticulously shaped to form the vessel's cylindrical body with hemi-heads at each end. The interior is rendered seamless by strategically welding titanium batten strips, ensuring a tight seal containing the pressurized acidic slurry.

Routine maintenance shutdowns are inevitable to address issues such as leakage, corrosion, and erosion within the autoclave lining. Repair procedures involving the removal and replacement of batten strips and subsequent welding pose concerns regarding the impact of the titanium cladding's material properties. Notably, the potential formation of intermetallic compounds and consequent cracking in the autoclave wall lining remains a looming threat.

This presentation aims to unveil findings regarding the critical threshold of titanium cladding thickness that must not be compromised to mitigate the risk of intermetallic formation and subsequent structural integrity issues. By offering essential insights into long-term maintenance strategies for autoclaves, this research bridges the knowledge gap essential for ensuring the sustained efficiency and safety of HPAL processes.

Keywords: High-Pressure Acid Leach, HPAL, severe service, autoclave, explosion bonded, clad titanium, cladding, carbon steel, sulphuric acid, equipment, corrosion, erosion, performance, high temperature, weld repair, properties, performance, batten strips, cracks, failure, NDT, non-destructive testing, hardness, x-ray fluorescence, intermetallic, microscopy, energy dispersive spectroscopy, SEM, EDS.