Endurance Technologies & Alonizing

Introduction

Endurance Technologies is pleased to add Alonizing and its associated processes to the patented boronizing process the company currently offers to customers throughout North America.

Endurance was founded in 1993 and its modern 18,000 square foot manufacturing facility is located in Calgary, Alberta, Canada. Boronizing steel equipment, especially down-hole production tubing, for the oil and gas industry is Endurance's strength. Alonizing and boronizing are both diffusion alloying processes. Alonizing customers will benefit from Endurance's specialized equipment and expertise in processing tubular and other products.

Technical Benefits

- High corrosion resistance
- Case depth up to .015" for tubing
- Operates in continuous temperatures up to 1750 degrees F
- Retains the base steel's inherent strength and rigidity, depending on base material
- Does not change the high-temperature mechanical properties of the base steel
- Utilizes Endurance Technologies' patented diffusion alloying process

Common Applications

- **Sulfuric acid/acid gas removal**: Resists sulfidation from H_2S, SO_2, and SO_3; increases tube life up to 20 years
- **Refining**: charge heaters, delayed cokers, sulfur recovery, heat exchangers
- **Petrochemical**: reformers, ammonia, heat exchangers
- **Reformers - DRI**: Secondary reformers, waste heat boilers
- **Boilers**: PR boiler (pulp and paper), waterwall panels, traditional boilers

Alonizing

Alonizing Process

Alonizing is a metallurgical process that diffuses aluminum into the surface of carbon steel, stainless steels and alloys, providing excellent protection against elevated-temperature scaling, corrosion oxidation, carburization and hydrogen permeation.

During Endurance Technologies' Alonizing process the steel is positioned in a retort and surrounded by a mixture of blended aluminum powders. The steel can be Alonized on the inner diameter, outer diameter or both. The steel is then heated to a pre-determined temperature for a specified period of time. The aluminum turns into a vapour and diffuses into the substrate of the steel, penetrating from a depth of .002" to .015".

The end result of the Alonizing process is a true alloy with the base steel. Alonizing is not a coating and there is no mechanical interface with the substrate. The protective diffusion zone cannot be removed, except by a machining operation.

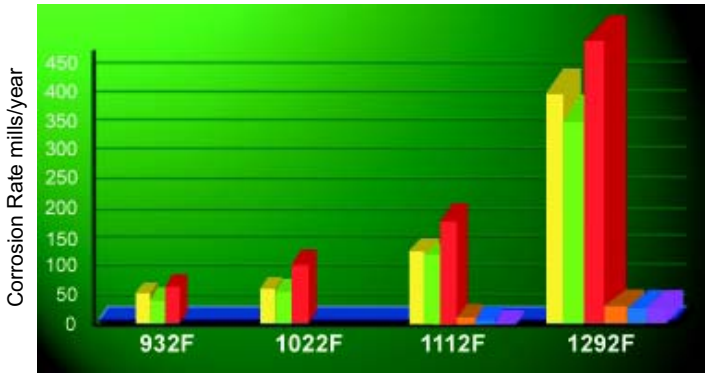
Plain Carbon Steel (with scaling)

Alonized Carbon Steel (no scaling)

Carbon steel subjected to high-temperature oxidation

Sulfidation Rates

50 Vol% H_2, 50% Vol H_2S, 1 Atm, 50



Alonizing Process - Tubing

One of Endurance's custom-built furnaces for diffusion alloying tubing. The furnaces can process tubes up to 37' long and 5.5" diameter. Tubes can be Alonized on the inside diameter, outside diameter, or both.

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