

Air Products' Atmosphere Humidification System



Courtesy of St. Mary's Pressed Metals

Service life of a stainless steel mesh belt can be extended by increasing the dew point of a dry nitrogen-hydrogen furnace atmosphere using a humidification system, which can reduce manufacturing costs and downtime.

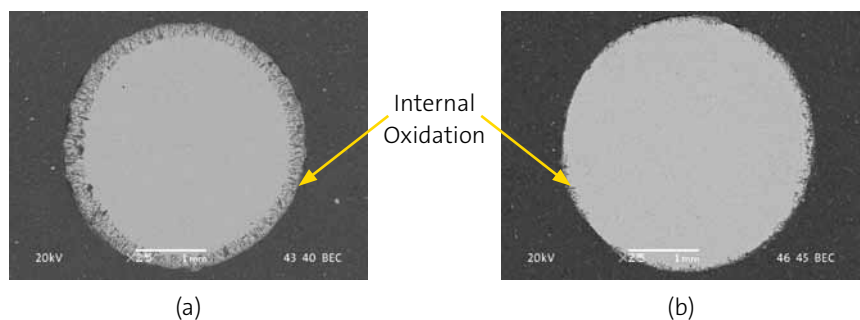
Benefits of the system

- Cost-efficient
- Easy to install
- Provides an optimum level of humidification to the furnace atmosphere
- Holds dew point constant over a wide range of ambient temperatures
- Humidification level can be controlled to achieve a range of dew points
- Optional close-loop control
- Separate from and independent of any humidification system used for helping with the de-lubrication step
- Does not require any incremental atmosphere flows
- Does not change the flow balance and dynamics within the furnace

Humidified atmosphere effects on the belt microstructure and properties

- Ability to maintain more protective surface oxide layer that is adherent and non-scaling
- Reduced carbon and nitrogen pickup in stainless steel belts
- Decreased concentration of chromium carbide, nitride and carbonitride particles in the matrix and along the grain boundaries
- Diminished depth of internal oxidation and chromium-depleted zone
- Increased tensile strength and increased elongation
- Reduced brittle failure

The micrographs illustrate a significant reduction in the rate of belt deterioration when a dry nitrogen-hydrogen atmosphere was replaced with a humidified atmosphere of the same basic composition. On average, the depth of internal oxidation for the belt from the humidified atmosphere is about half that for the belt from the standard nitrogen-hydrogen atmosphere. Based on production furnace trials, a belt-life improvement of 34% was demonstrated over comparable non-humidified atmospheres.



Internal oxidation in the subsurface region of belt spiral wire after 11 months of service, transverse cross-section, back-scattered electron images: (a) standard atmosphere; (b) humidified atmosphere.

For more information

We can help you achieve more cost-effective operations, improve safety and environmental compliance, and give you added flexibility to compete in the global marketplace. To learn more about our global metals processing capabilities, or to tell us more about your needs, contact us at the office nearest you.



Anna Wehr-Aukland, one of our metals processing experts, is here to help you achieve cost-effective operations.

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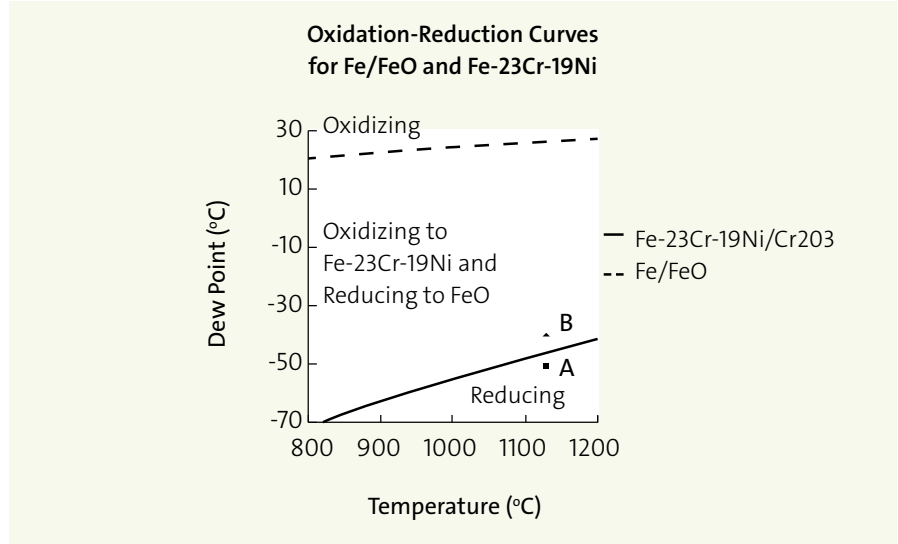
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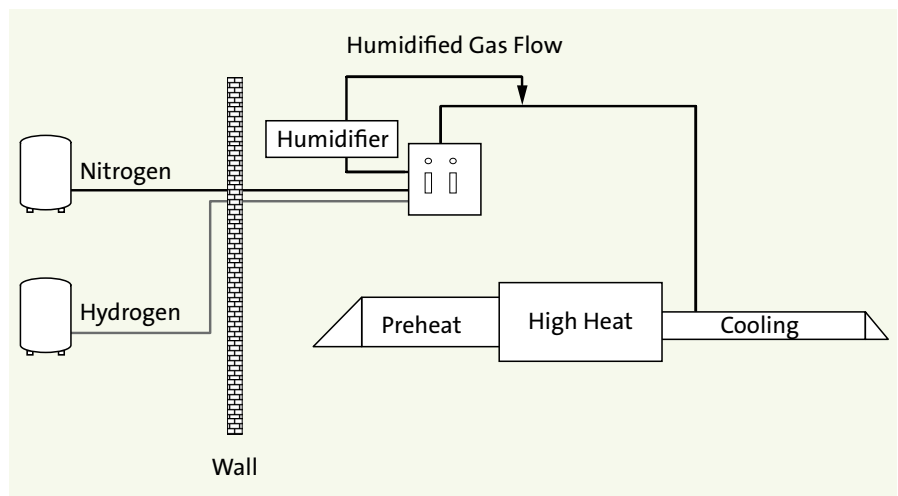
Dewpoint selection

The humidified atmosphere must be oxidizing to the stainless steel belt and, at the same time, reducing to the production parts. An optimal dew point, which depends on the composition of the furnace atmosphere and process temperature, can be selected based on thermodynamic calculations. The graph below presents the optimal dew point for sintering carbon parts in N_2 -6% H_2 atmosphere at 1130 °C (point B).



System installation

The humidification system can be easily installed into the existing gas supply piping to the furnace. A side stream of the nitrogen gas is humidified and then reintroduced into the main gas stream for the furnace.



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