Smart gas solutions for optimising electrical steel strip production

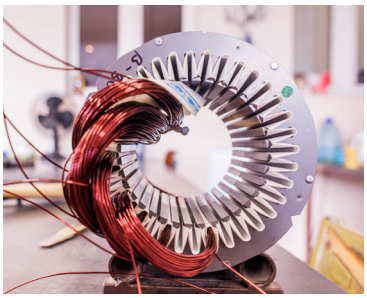
As the world continues to transition away from fossil fuels to more renewable forms of energy, electrical steel strips are key to enabling the advancement of electric vehicles (EV) and electrical infrastructure. Largely responsible for EV motor performance and efficiency, these extremely thin, high-performance grade steel strips are in high demand for this application. They are also used extensively across a broad range of other products from transformers and generators to actuators.

The process challenges in decarburization

Manufactured from special alloyed steels to control the grain size and other vital characteristics – as well as facilitating its magnetic polarization – in some cases the desired carbon content needs to be as low as 20 wt. part per million (ppm). An important step to reduce excessive carbon is through decarburizing – but process conditions need to ensure oxidation and removal of the carbon while avoiding oxidation of the actual metal. Equally, insufficient decarburizing can cause its own problems.

Typical decarburizing relies on an annealing process at 750 to 850°C in a nitrogen and hydrogen-based atmosphere, to which an amount of oxidative agent (e.g. water, oxygen, air etc.) is added. It is vital that the gas composition of the furnace atmosphere remains within certain limits to avoid iron oxidation while still reliably optimising the decarburizing process.

Solutions to optimize the decarburization atmosphere



Air Products offers a range of advanced solutions to monitor furnace atmosphere in real time. Through furnace atmosphere measurement we can analyse dew point and hydrogen content also in wet atmospheres, so that you can dose the optimal amount of oxidation agent, but also other components to monitor decarburization reactions.

Air Products Solutions:

Air Products Smart Technology: enables furnace data collection and evaluation. Helpful for both decarburizing and passivation processes, our Smart Technology can be connected to an existing control box and configured to your existing equipment through an extensive range of analysers and sensors. Higher levels of Air Products Smart Technology offer also trend evaluation and advice on non-standard operational and maintenance issues.

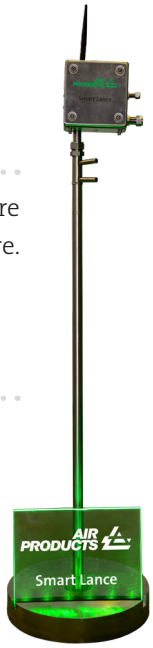
Advanced Atmosphere Control System (ACS): a Smart Technology extension used to regulate oxidation media dosing according to existing values. Even furnaces designed for a constant flow of all media can be retrofitted by ACS, with the furnace operating at a constant dew point, but with the oxidating agent now regulated on demand. Making the production process more stable, it will cover variability of conditions including surface purity and moisture.

PQT sensor: this simple sensor measures the density of a furnace atmosphere, calculating the mean molar weight of gas. In binary gases such as hydrogen and nitrogen, it determines composition and gives feedback on the ratio, so replacing a costly gas analyser. It can be also used to crosscheck process status as almost every atmosphere composition change will affect the molar weight too.

Sample Gas conditioning Systems: monitoring and analyzing a highly humidified atmosphere in itself has challenges. Water condensation has an impact on the measured results as well as on the performance and reliability of the sensors. A combination of in-situ sensors and extraction systems protecting external sensors allows a representative monitoring of the atmosphere conditions to the material.

Humidification system: The Smart Lance allows direct injection of water into the furnace atmosphere avoiding pre-vaporisation and water vapor infrastructure on site to humidify the furnace atmosphere. However, if direct water injection is not possible, Air Products offers a wide range of different humidification systems based on water vaporization or catalytic reactions. Please ask our experts to support you in choosing the most economic and reliable technology for your process.

Smart Lance: designed to protect the dispensed water over heating and resultant limescale deposition. Including temperature and pressure monitoring for both water and carrier gas, the values are uploaded to the Cloud in real time. If detected pressure rises over certain limits, an alarm is raised in both the control box and the Cloud dashboard. Smart Lance's sister solution - Standard Lance - is also available, which provides the same hardware design benefits but without sensors or data output.



Services:

Air Products expertise goes far beyond gas production and delivery. As a leading global supplier of technical gases to the metals industry we have developed an extensive range of services, systems and solutions designed specifically to help you improve product consistency, reduce capital investment and significantly lower maintenance requirements.

These include:

- Furnace and process audits
- Safety assessment
- Start-up values recommendation and support
- Consulting for process optimization and trouble shooting
- Product-based solutions including analysers and sensors
- On-site gas generation of hydrogen and nitrogen

For more information, please contact us at:

Air Products PLC
T 0800 389 0202
apukinfo@airproducts.com
airproducts.co.uk

Air Products Ireland Ltd.
T 1800 99 50 29
ieinfo@airproducts.com
airproducts.ie

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tell me more
airproducts.co.uk

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