The Importance of Measuring Organic Contamination Prior to Welding

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Welding metal — especially in high-precision or high-integrity environments like aerospace, automotive, medical devices, or electronics — comes with a range of contamination-related challenges that can compromise weld quality, mechanical properties, and corrosion resistance. One of the key process stages in achieving high quality welds is ensuring that the metal surface is free of organic contamination. Organic contaminants, such as oil, grease, and hydrocarbons can impact the welding process and the integrity of the weld. Measuring the amount of organic contamination prior to welding is a quality assurance step that can be overlooked. Here we highlight the importance of measuring organic contamination prior to welding and discusses best practices for contamination control.

Impact of Organic Contamination on Welding
Metal surfaces in production environments are susceptible to contamination, and the presence of organic contaminants on the surface can lead to several welding issues, including:

- **Porosity:** During welding, organic materials decompose into gases that become trapped in the weld pool, leading to porosity and weakened weld strength.
- **Incomplete fusion and lack of penetration:** Contaminants act as a barrier between the base metal and the weld filler, preventing proper fusion.
- **Hydrogen embrittlement:** Hydrocarbons can introduce hydrogen into the weld pool, which contributes to cracking and reduced ductility.
- **Reduced corrosion resistance:** A contaminated weld is more susceptible to corrosion, reducing the longevity of the welded structure.



Figure 1 – Organic contamination present on metal surfaces during welding can impact the integrity of produced welds

Methods for Measuring Organic Contamination
To ensure high quality welds, it is important to measure and control organic contamination before welding. Some common methods for assessing contamination levels include:

1. **Solvent wipe test:** Using a clean, lint-free cloth with a solvent such as acetone to wipe the surface and observing residue transfer.

2. **Relative Fluorescence Measurement (RFU) using the CleanoSpector:** A non-destructive method that detects organic contamination through fluorescence response. The instrument will display a numerical value proportionate to the amount of organic contamination on the surface of the material. The higher the number the greater amount of contamination.

3. **Contact angle measurement:** Measuring the wettability of a surface using water droplets to assess the presence of oils or grease.



Figure 2 – A SITA CleanoSpector detects organic contamination on metals by measuring fluorescence

Best Practices for Contamination Prevention and Removal
To minimise organic contamination and improve weld quality, the following best practices should be considered:

- **Proper cleaning procedures:** Use appropriate solvents, alkaline cleaners, or vapor degreasing to remove organic residues before welding.

- **Surface preparation:** Mechanical or chemical methods, such as wire brushing or etching, can help remove residual contaminants.

- **Controlled handling:** Use gloves when handling metal parts to prevent contamination from skin oils.

- **Storage considerations:** Store parts in clean, dry environments to avoid exposure to airborne contaminants.

- **Regular testing and monitoring:** Implement routine cleanliness checks to ensure surfaces remain free of organic contamination before welding.

Conclusion
Measuring and controlling organic contamination prior to welding is essential for producing defect-free, high-quality welds. The presence of organic contaminants can lead to serious weld defects, including porosity and poor mechanical properties such as cracking. By employing proper testing and cleaning techniques, manufacturers can improve weld integrity, enhance product reliability, and extend the lifespan of welded structures.
The CleanoSpector will allow users to assign a RFU value to their acceptable cleanliness level. This can help to drive weld quality improvement by tracking where sources of the organic contamination are present in the flow of the component through the manufacturing process.

Implementing these repeatable and robust measurement solutions will ensure that welding processes meet stringent industry standards and performance requirements.

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