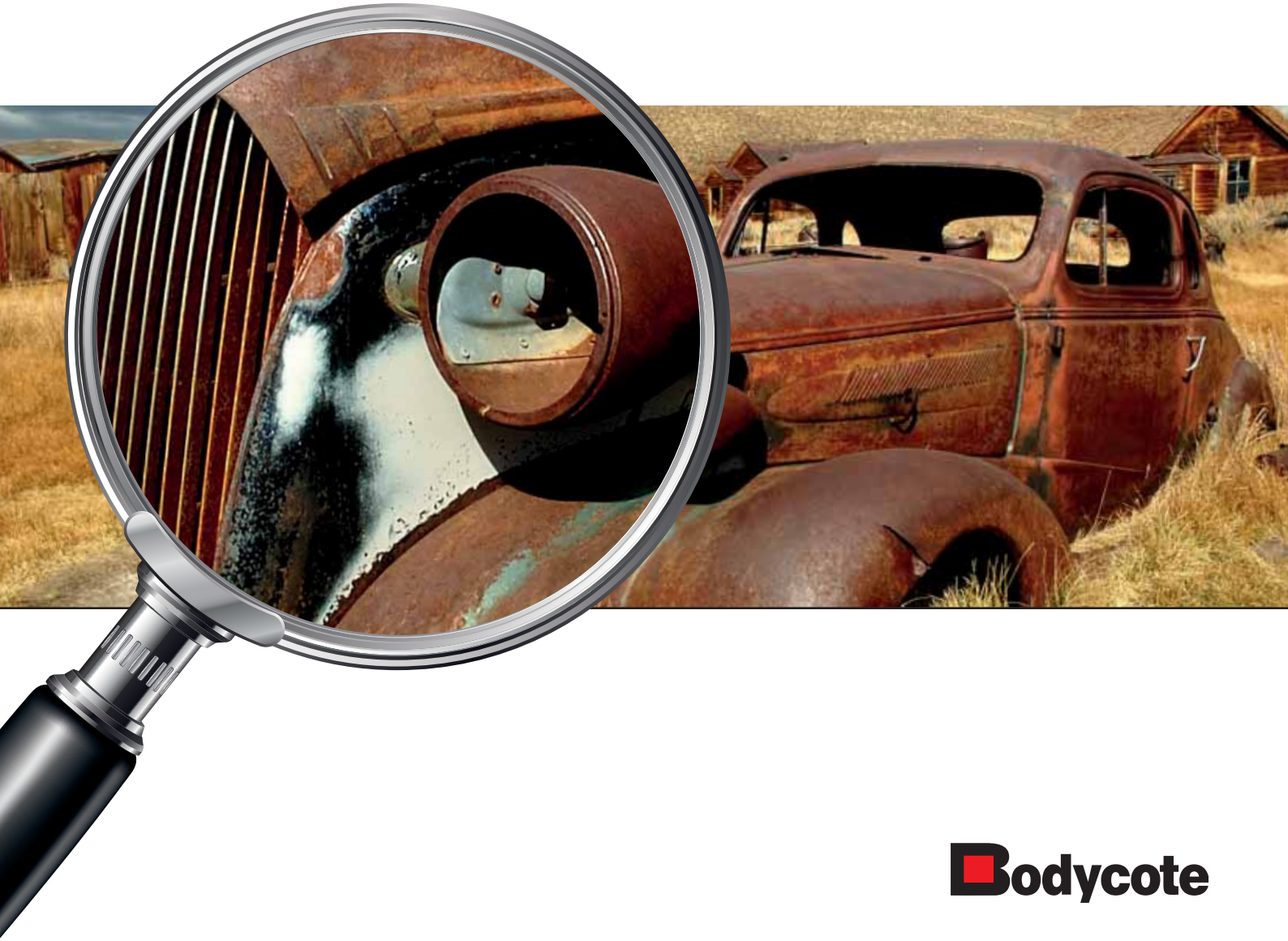
In the SPOTLIGHT

S³P: SALT SPRAY TEST – SUITABLE FOR STAINLESS STEELS?

ISO 9227 DEVELOPED FOR COATINGS

SUITABILITY FOR STAINLESS STEELS IS LIMITED

SEVERAL INFLUENCING VARIABLES



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S³P – Specialty Stainless Steel Processes
Salt Spray Test

The benefits of salt spray testing are questionable

For many applications corrosion resistance is a key property when choosing the material grade. In most cases the material performance under service conditions cannot be tested properly and in an acceptable time frame. This is why accelerated corrosion tests are performed, and probably the best known is the salt spray test (SST) according to ISO 9227:2012 and ASTM B117. But, does this method provide a realistic result for stainless steel? The salt spray test was designed to assess the quality of coatings, e.g. porosity. For many stainless steels, the aggressive salt spray solution (even harsher than sea water) leads to a failure in the test. In real life service the steel withstands decades.

Test advantages

- Limited cost
- Relatively short test duration
- Well standardised
- Results are easy to understand

But the standard ISO 9227 itself states: "It is often not possible to use results gained from salt spray testing as a comparative guide to the long-term behaviour of different coating systems, as the corrosion stress during these tests differs significantly from the corrosion stresses encountered in practice."

Test disadvantages

- Very unreliable results
- Cannot be correlated to actual performance in service
- Behaviour of most coatings in SST is completely different to stainless steels; see Fig. 1
- Influences of UV radiation or mechanical impact (e.g. stone chipping) are not taken into account
- Used for comparison, more qualitative than quantitative

Further, the performance of an alloy is highly dependent on the surface condition, especially roughness and wettability. This influences the time of contact of the salt solution droplets, because the flat surfaces are typically placed 20° from the vertical; see Fig. 2. Thus, testing 3D parts in the salt spray test can lead to misleading results, as the medium might be trapped in horizontal areas; see Fig. 3. Results of a salt spray test often lead to inacurate conclusions when predicting the in-service behaviour. More suitable tests to assess the corrosion resistance of stainless steels are qualitative/quantitative tests with variation of the temperature parameter or potentially:

- Critical pitting temperature test acc. to ASTM G48 or ASTM G150
- Electrochemical critical pitting potential measurements
- NACE TM 0177 / ASTM G39 for combined corrosive and mechanical load

Further information

- ISO 9227:2012: Corrosion tests in artificial atmospheres - Salt spray tests
- ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus
- The salt spray test and its use in ranking stainless steels, International Stainless Steel Forum (ISSF), 2008

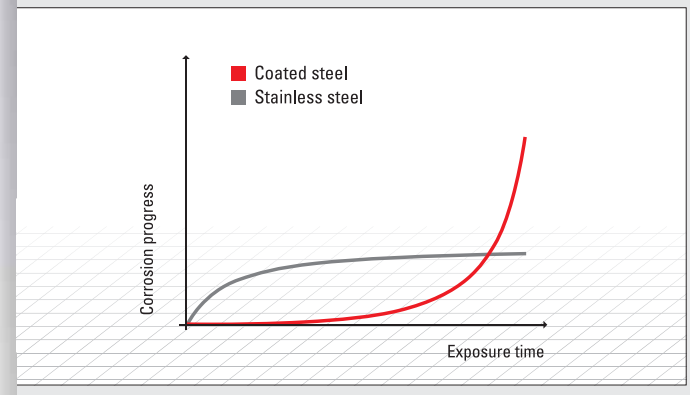

Fig. 1 Different mechanisms of coated steel and stainless steel in salt spray test (ISSF, 2008).

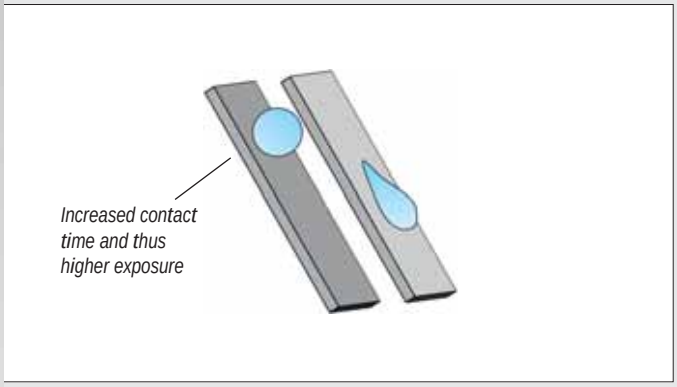

Fig. 2 Influence of surface wettability, (ISSF, 2008).

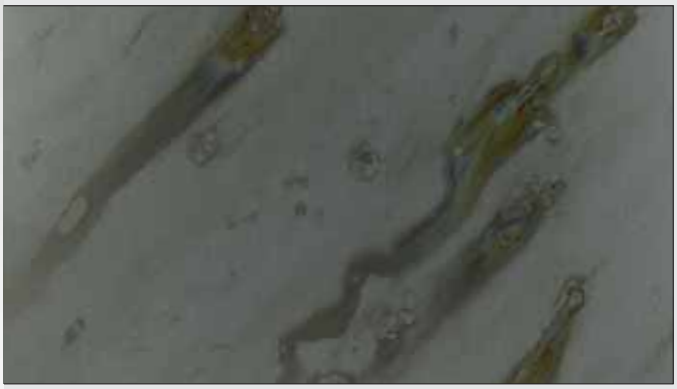

Fig. 3 Corrosion starting at surface defects on AISI 316L sheet due to a change in wettability; accelerated salt spray test after 72 h.

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10.2018/EN 422-1859