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Supplementary Information

Effects of NaCl Concentration on Wear-corrosion Behavior of SAF 2507 Super Duplex Stainless Steel

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$$T= \frac{m_0\text{-}m_1}{S \times \rho \times t} \quad [1]$$

$$C= \frac{K \times i_{corr} \times EW}{\rho} \quad [2]$$

Where T is mechanical wear rate, m_0 is initial mass of material, m_1 is the final mass of material, S is the area of corrosion, ρ is the density, t is the corrosive wear test duration, C is the electrochemical corrosion rate. K is a constant 3.27×10^{-3} in mm·g/μm·cm·yr, EW is the material equivalent weight, i_{corr} is the corrosion current density.

The interaction relationship between wear and corrosion is shown as follows:

$$T=W_0+C_0+S \quad [3]$$

$$S=\Delta C_w+\Delta W_c \quad [4]$$

$$W_c=W_0+\Delta W_c \quad [5]$$

$$C_w=C_0+\Delta C_w \quad [6]$$

Where T is the total mass loss rate of wear-corrosion, W_0 is the wear rate without corrosion, C_0 is the corrosion rate without wear, S is the sum of the interactions between corrosion and wear determined by Eq. 4, ΔC_w is the change in corrosion rate due to wear, ΔW_c is the change in wear rate due to corrosion (the units of all the parameters mentioned above are $mm\cdot y^{-1}$).

According to ASTM G119-09 [19], the dominating effects of the regimes can be defined as follows:

$\frac{\Delta C_w}{\Delta W_c}<0$ Antagonistic effects dominate (Corrosion inhibits wear) [7]

$0<\frac{\Delta C_w}{\Delta W_c}<0.1$ Synergistic effects dominate (Corrosion is affecting wear greatly) [8]

$0.1\leq\frac{\Delta C_w}{\Delta W_c}<1$ The "additive" and "synergistic" interactions are equal (Wear is affecting corrosion to an equal to corrosion is affecting wear) [9]

$\frac{\Delta C_w}{\Delta W_c}\geq 1$ Additive effects dominate (Wear is affecting corrosion greatly) [10]

Wear-corrosion synergism degree is depicted by three dimensionless factors. They are total synergism factor, corrosion augmentation factor and wear augmentation factor. They are all calculated as follows, respectively.

$$\frac{T}{T-S} \quad [11]$$

$$\frac{C_0+\Delta C_w}{C_0} \quad [12]$$

$$\frac{W_0+\Delta W_c}{W_0} \quad [13]$$