Supplementary Materials: Effect of Heat Treatment of Martensitic Stainless Steel on Passive Layer Growth Kinetics Studied by Electrochemical Impedance Spectroscopy in Conjunction with the Point Defect Model

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Mott-Schottky Analysis

Mott-Schottky analysis were done to ensure n-type behavior of the passive layer at the polarization potential (0.6 V). Figure S1 shows the Mott-Schottky plot of a selected sample (T_A: 1200 °C). The passive film shows a positive slope between 300 and 900 mV indicating n-type behavior. Figure S2 shows the calculated defect densities N_D for all samples. N_D was calculated by the Mott-Schottky equation:

$$\frac{1}{C_{sc}^2} = \frac{2}{\varepsilon\varepsilon_0 e N_D}\left(E - E_{fb} - \frac{kT}{e}\right) \quad \text{(SI1)}$$

in which ε describes the permittivity of the oxide (that can be assumed as 12 for oxide layers on stainless steel [33]), ε_0 the permittivity of the vacuum (8.85×10^{-12} C/(Vm)), e the elementary charge of an electron (1.902×10^{-19} C), E_{fb} the flatband potential, k the Boltzmann constant (1.38×10^{-23} J/K), T the temperature, and N_D concentration of dopants.

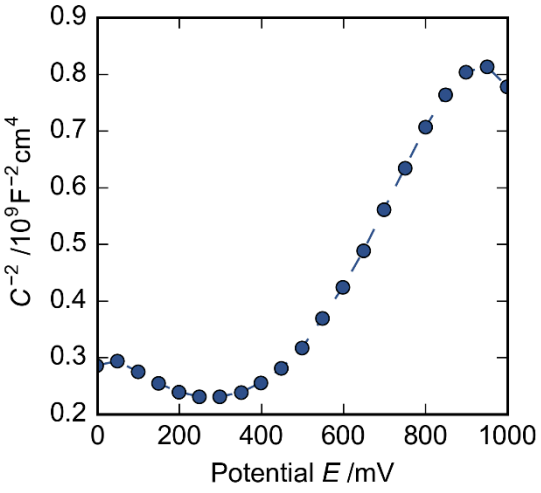

Figure 1. Mott-Schottky plot of martensitic stainless steel sample (austenitizing temperature T_A: 1200 °C) after passive film formation at 600 mV for 1800 s.

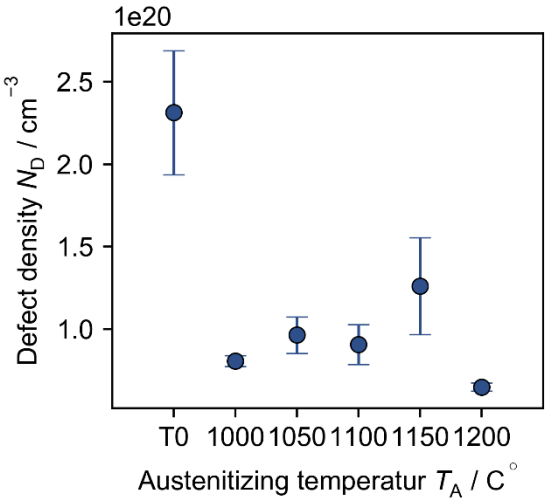

Figure 2. Calculated defect densities of the passive layer of martensitic stainless steel after different heat treatments.