

# In-situ AFM Studies of Surfactant Adsorption on Stainless Steel Surfaces during Electrochemical Polarization

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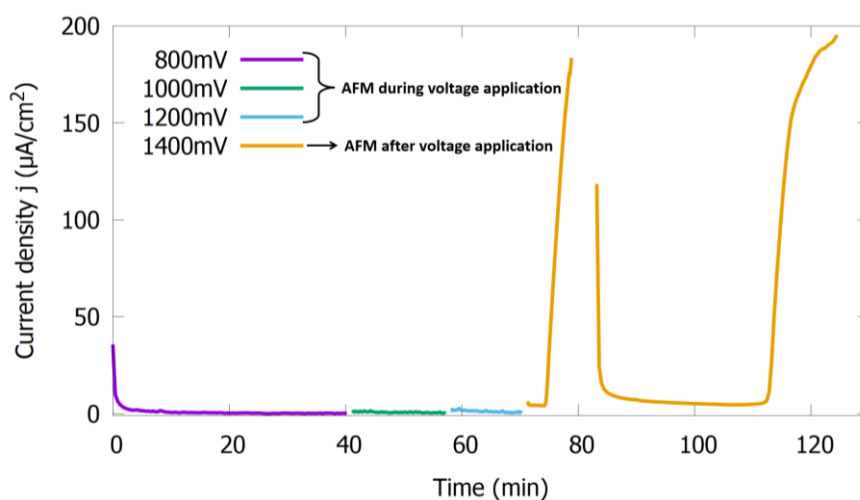
## Supporting Information

**Table S1.** Corrosion current densities  $j_{\text{corr}}$  of the 1.4510 stainless steel, without surfactants 0xCMC and with increasing concentration of FAES, LAS and PKO in NaCl solution (500 mg/L Cl<sup>-</sup> and pH 5.9 at 30°C).

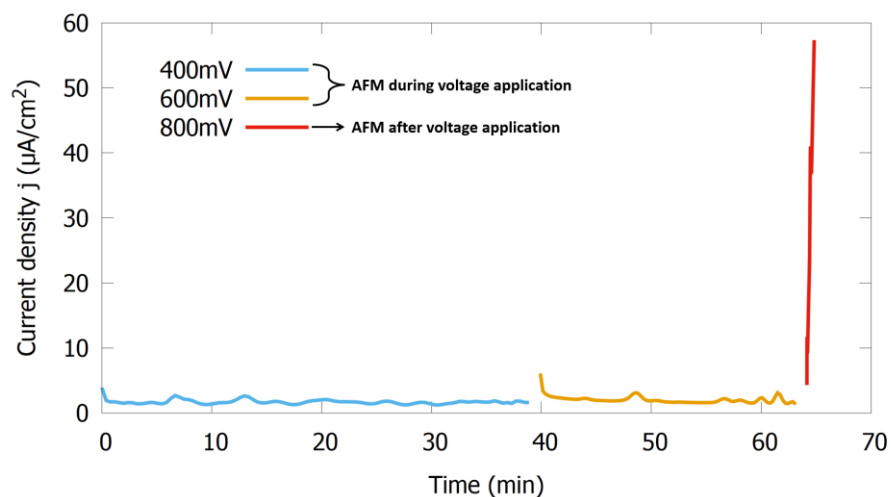
CMC FAES	$j_{\text{corr}}$ [ $\mu\text{A}/\text{cm}^2$ ]	$\Delta j_{\text{corr}}$ [ $\mu\text{A}/\text{cm}^2$ ]
0x	0.074	0.003
1x	0.086	0.015
2x	0.040	0.012
4x	0.090	0.042
8x	0.213	0.246
16x	0.078	0.041
32x	0.164	0.045
160x	0.236	0.026
CMC LAS	$j_{\text{corr}}$ [ $\mu\text{A}/\text{cm}^2$ ]	$\Delta j_{\text{corr}}$ [ $\mu\text{A}/\text{cm}^2$ ]
0x	0.074	0.003
1x	0.388	0.097
2x	0.322	0.233
4x	0.125	0.028
8x	0.146	0.061
16x	0.103	0.012
32x	0.090	0.009
160x	0.052	0.019
CMC PKO	$j_{\text{corr}}$ [ $\mu\text{A}/\text{cm}^2$ ]	$\Delta j_{\text{corr}}$ [ $\mu\text{A}/\text{cm}^2$ ]

0x	0.074	0.003
8x	0.124	0.048
10x	0.046	0.030
20x	0.034	0.005
40x	0.034	0.006
80x	0.048	0.012
160x	0.066	0.007

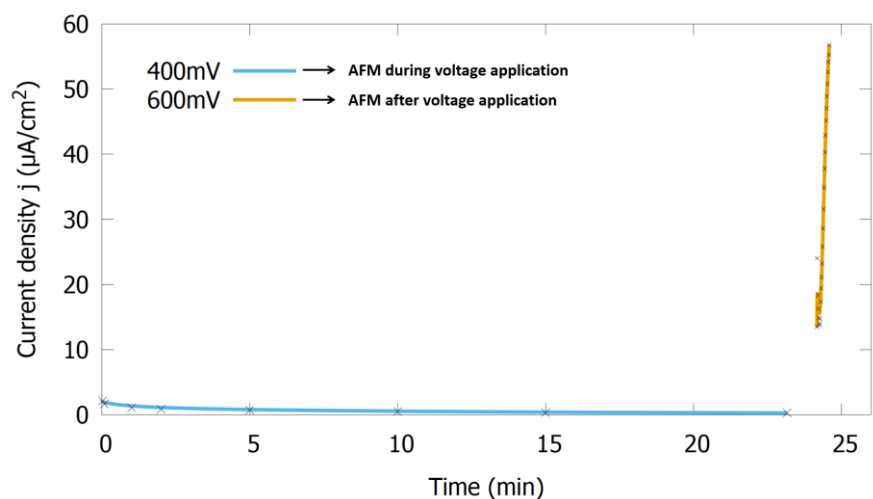
The recorded current over time of the in-situ AFM measurement are depicted in Figure S1-3. For potential differences below the  $E_{bd}$ , the current density remains nearly constant. As described before and depicted in the Figures, the stainless steel was imaged with the AFM while the voltage was applied as long as the current stayed constant and after the current increased significantly. It was no or no additional adsorption of surfactants detectable until the current density increased significantly. The data were plotted with a Bezier curve to smooth the noise using the open source software gnuplot.



**Figure S1.** Current density over time of the 1.4510 in NaCl solution (500 mg/L  $\text{Cl}^-$  and pH 5.9 at 30°C) with FAES at 16xCMC in the AFM electrochemical cell at different potential differences vs. Ag/AgCl.

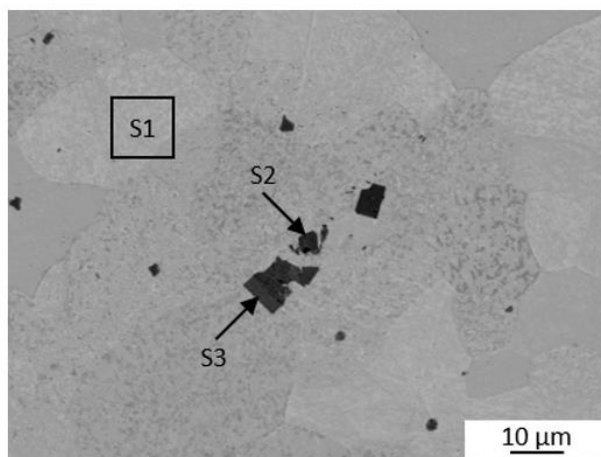


**Figure S2.** Current density over time of the 1.4510 in NaCl solution (500 mg/L Cl<sup>-</sup> and pH 5.9 at 30°C) with PKO at 16xCMC in the AFM electrochemical cell at different potential differences vs. Ag/AgCl.



**Figure S3.** Current density over time of the 1.4510 in NaCl solution (500 mg/L Cl<sup>-</sup> and pH 5.9 at 30°C) with PKO at 8xCMC in the AFM electrochemical cell at different potential differences vs. Ag/AgCl.

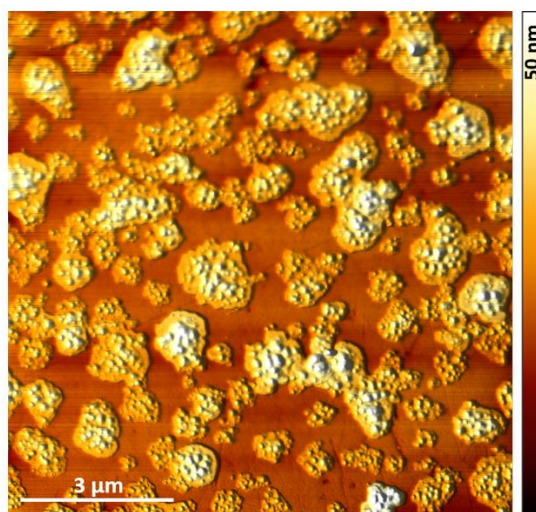
SEM investigations were performed to identify the precipitates as titanium carbon-nitrides. The EDS spectra in Figure S1 identified precipitates with a much higher nitrogen than carbon content. These titanium nitrides can also be identified under a light microscope due to their yellowish colour. Such precipitates were investigated with the AFM. The used SEM was a Sigma 300 VP (Carl Zeiss AG, Oberkochen, Germany). Energy dispersive X-ray spectroscopy (EDS) spectra were recorded with an X-Max 80 mm<sup>2</sup> (Oxford Instruments, Abingdon, England).



	Fe	Cr	Ti	C	N	O	Si
S1	79.54	17.56	0.4	2.07	-	-	0.42
S2	0.82	1.4	71.88	1.27	19.75	4.88	-
S3	1.17	-	73.66	1.2	19.61	4.36	-

**Figure S4.** SEM image of the polished 1.4510 with titanium precipitated. EDS spectra present the percentage composition of the steel matrix (S1) and two titanium nitride precipitates (S2,S3).

Figure S5 presets the PKO multilayer formation at 20xCMC with a surface coverage of about 45%.



**Figure S5.** AFM height image of 1.4510 steel surface in NaCl solution (500 mg/L  $\text{Cl}^-$  and pH 5.9 at 30°C) with PKO at 20xCMC after immersion showing multilayer formation.