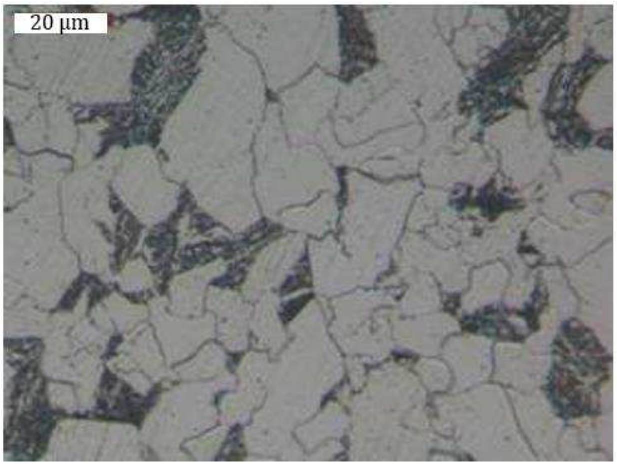


Figure 1: X65 carbon steel microstructure

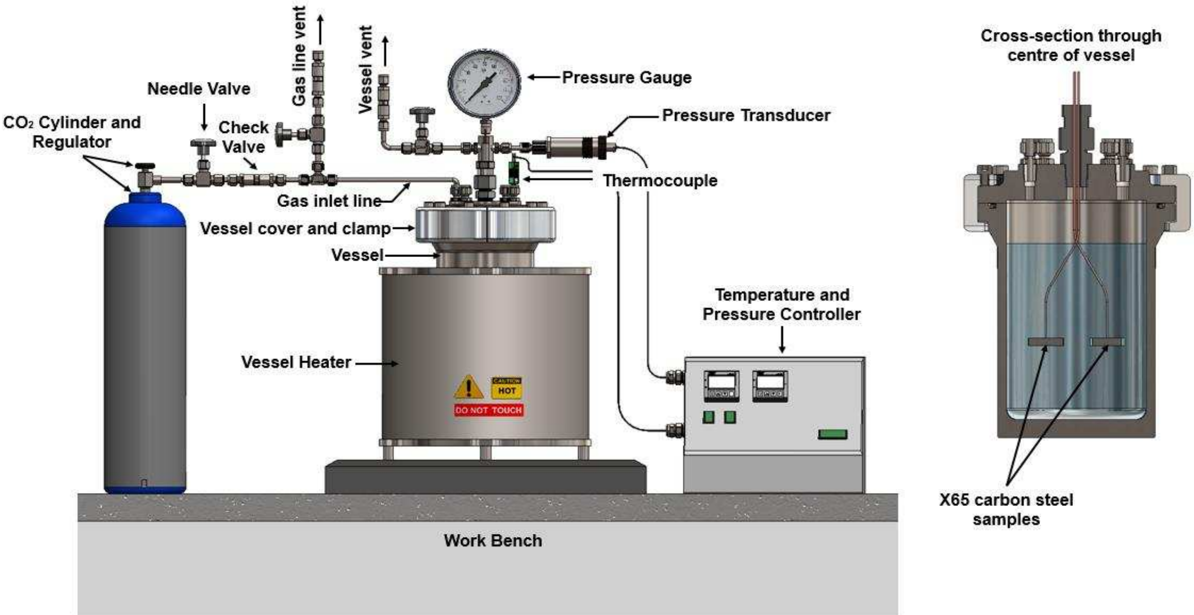
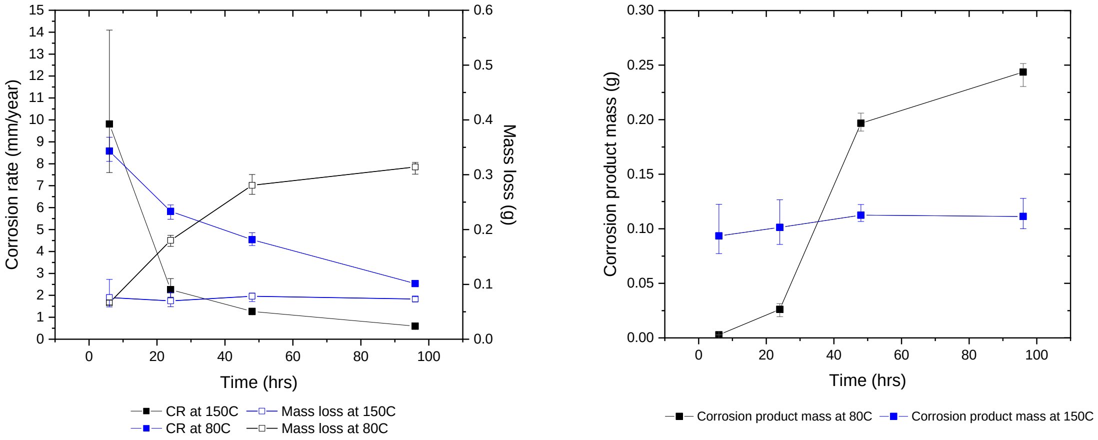
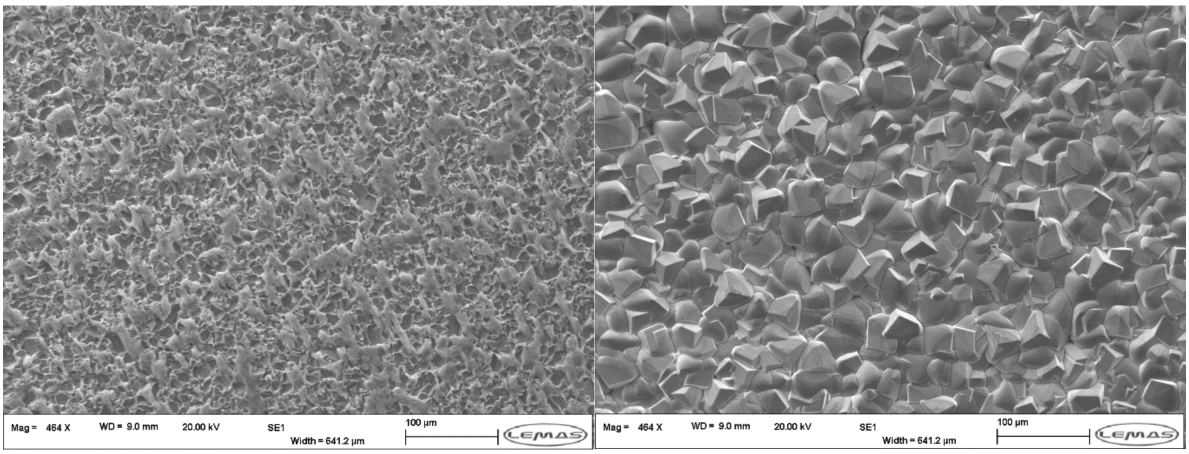


Figure 2: Schematic of autoclave set-up for evaluation of X65 carbon steel corrosion in CO_2-containing environments at elevated temperature

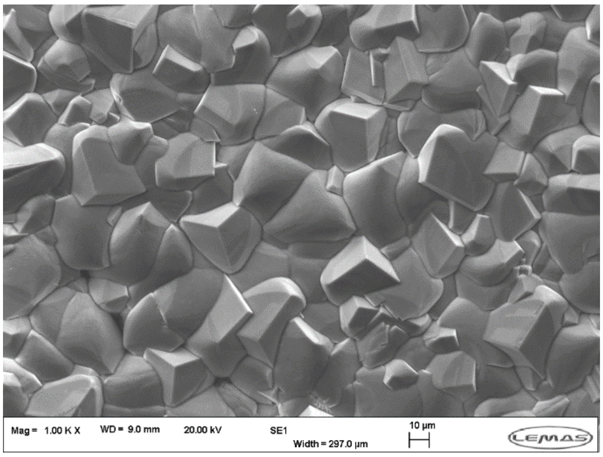


(a) **(b)**

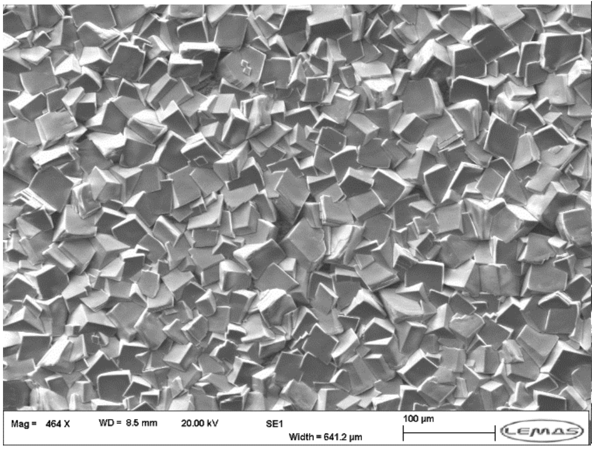
Figure 3: (a) Mass loss measurements and the corresponding calculated corrosion rates in mm/year and (b) corrosion product mass determined from mass gain measurements as a function of time for X65 carbon steel exposed to a CO_2-saturated 3 wt.% NaCl solution at 80 and 150°C



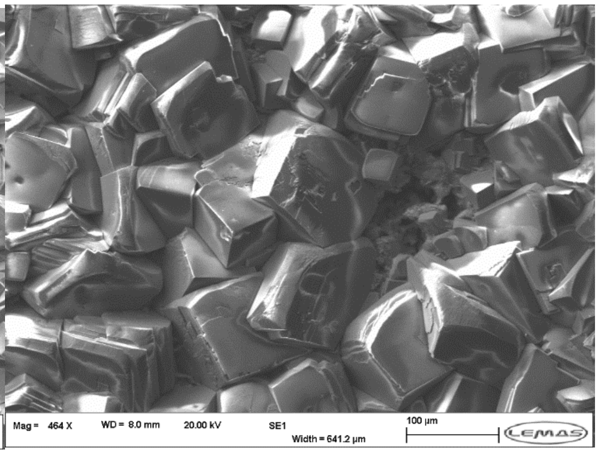
(a) **(b)**



(c)

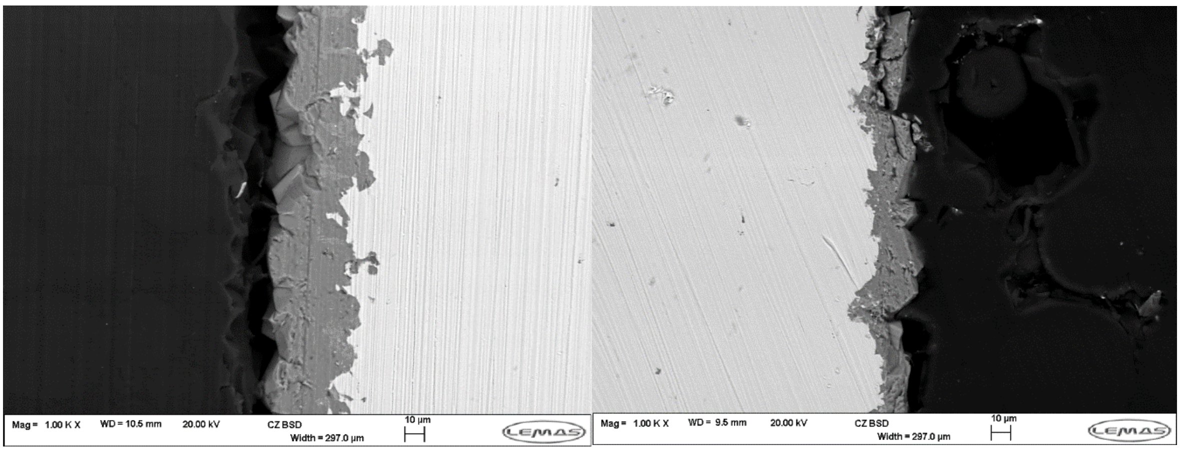


(d)



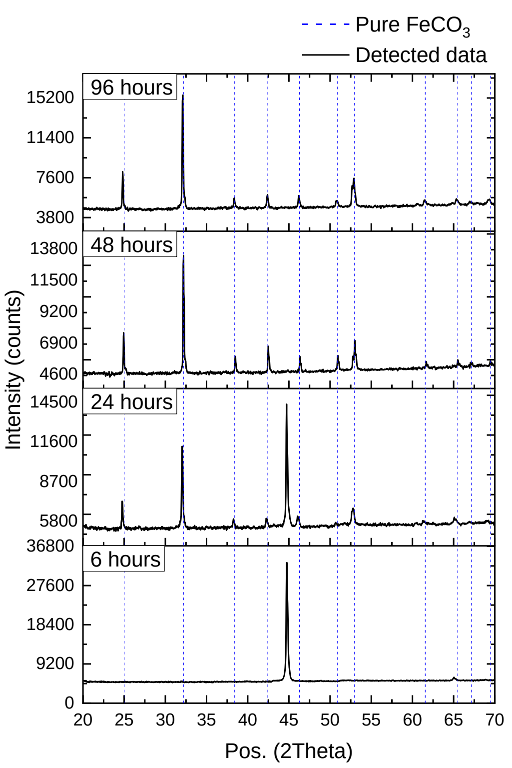
(e)

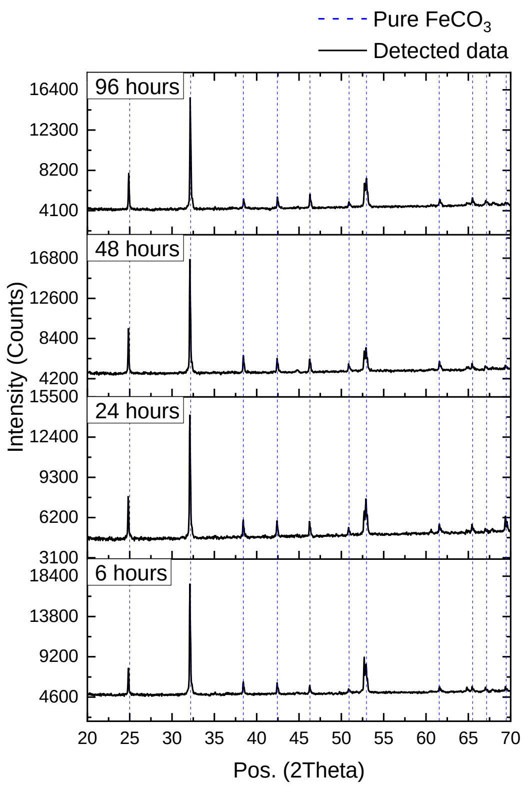
Figure 4: Top view SEM images of X65 carbon steel after exposure to a CO_2-saturated 3 wt.% NaCl solution after (a) 6 h at 80°C; (b) 96 h at 80°C; (c) 96 h at 80°C at higher magnification; (d) 6 h at 150°C and (e) 96 h at 150°C



(a) **(b)**

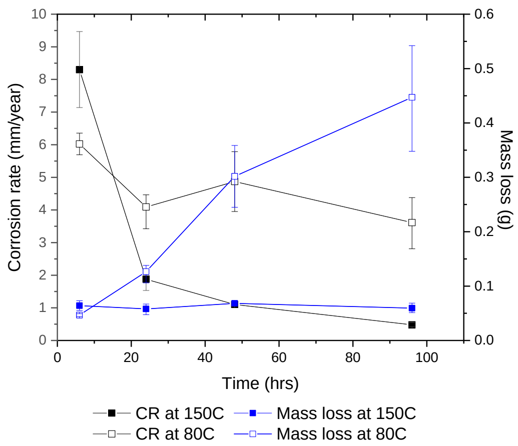
Figure 5: Cross-section SEM images of X65 carbon steel after exposure to a CO_2-saturated 3 wt.% NaCl solution after 96 h at (a) 80°C and (b) 150°C

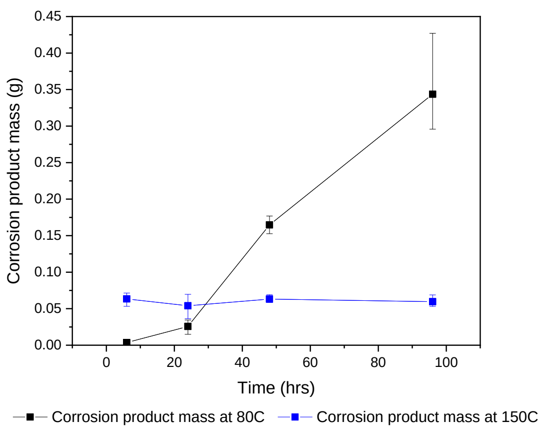




(a) **(b)**

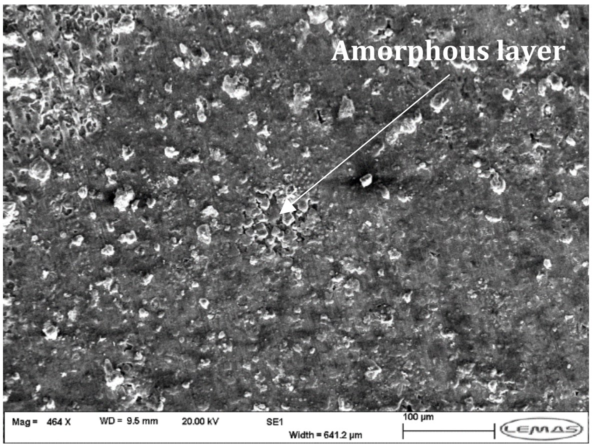
Figure 6: XRD patterns collected from X65 carbon steel surfaces exposed to a CO_2-saturated 3 wt.% NaCl solution for different time periods between 6 h and 96 h at (a) 80°C and (b) 150°C

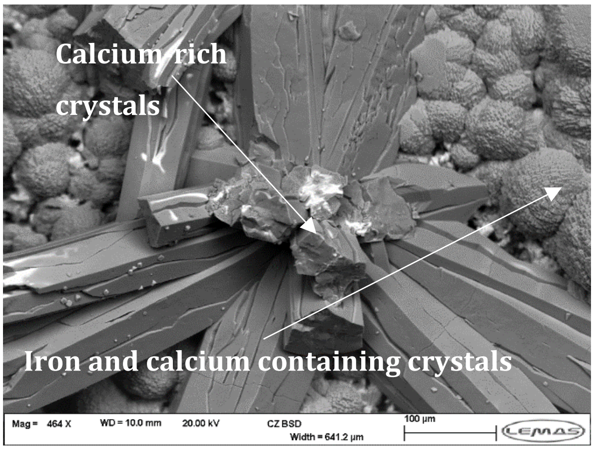




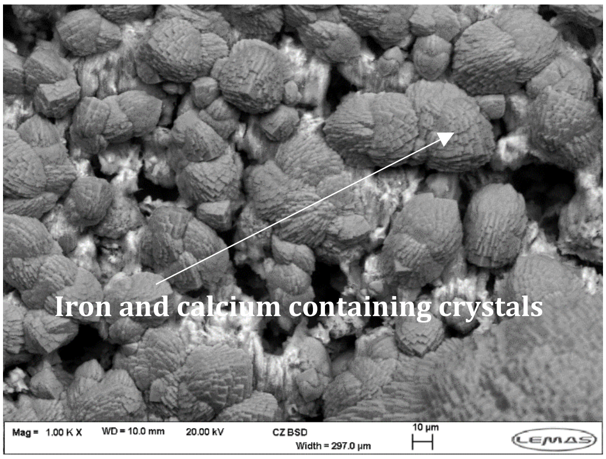
(a) (b)

Figure 7: (a) Mass loss measurements and the corresponding calculated corrosion rates in mm year^{-1} and (b) corrosion product mass determined from mass gain measurements as a function of time for X65 carbon steel exposed to a CO_2-saturated 1.54 wt.% NaCl solution with 1.83 wt.% $CaCl_2 \cdot 2H_2O$ at 80 and 150°C

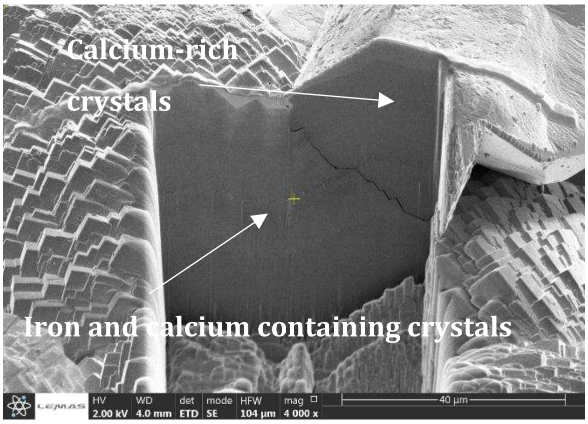




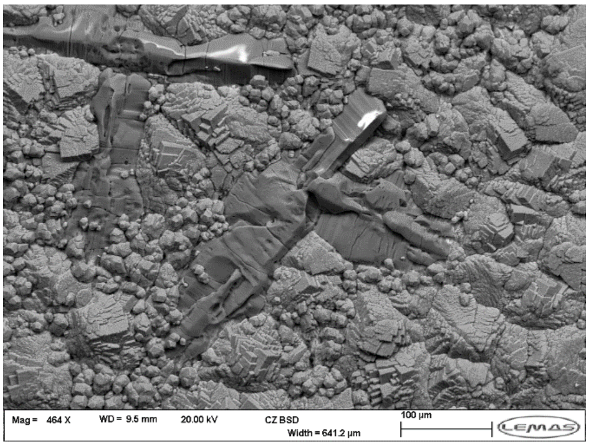
(a) (b)

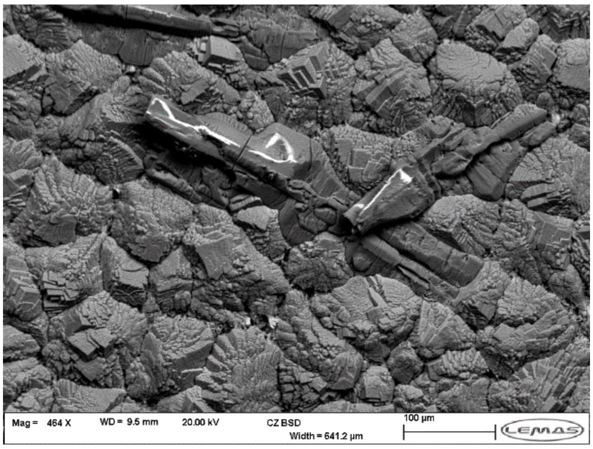


(c)



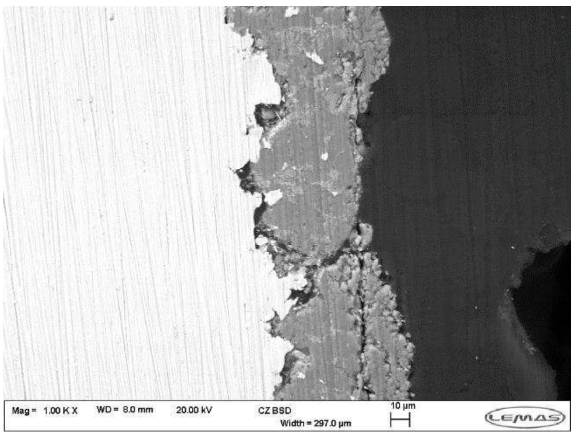
(d) **(e)**

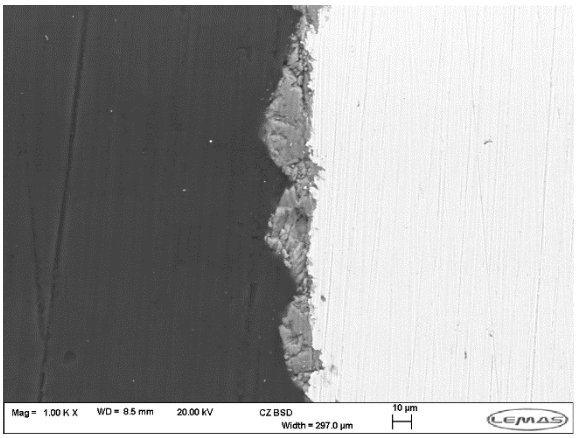




(f) **(g)**

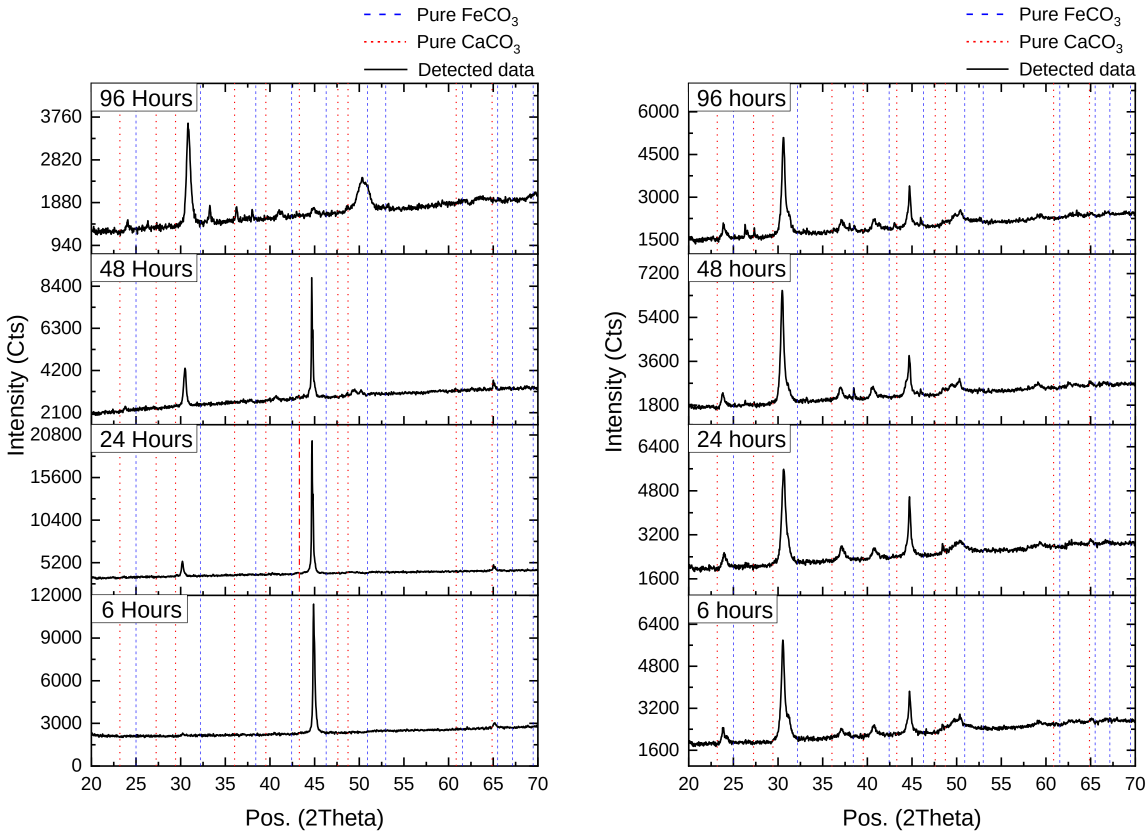
Figure 8: Top view SEM images of X65 carbon steel after exposure to a CO_2-saturated 1.54 wt.% NaCl solution with 1.83 wt.% $CaCl_2 \cdot 2H_2O$ after (a) 6 h at 80˚C; (b) 96 h at 80˚C; (c) 96 h at 80˚C at higher magnification (d) FIB-SEM 96 h at 80˚C; (e) FIB 96 h at 80˚C; (f) 6 h at 150˚C and (g) 96 h at 150˚C





(a) **(b)**

Figure 9: Cross-section SEM images of X65 carbon steel after exposure to a CO_2-saturated 1.54 wt.% NaCl solution with 1.83 wt.% $CaCl_2{\cdot}2H_2O$ after 96 h at (a) 80˚C and (b) 150˚C



(a) **(b)**

Figure 10: XRD patterns collected from X65 carbon steel surfaces exposed to a CO_2-saturated 1.54 wt.% NaCl solution with 1.83 wt.% $CaCl_2{\cdot}2H_2O$ for different time periods between 6 h and 96 h at (a) 80˚C and (b) 150˚C

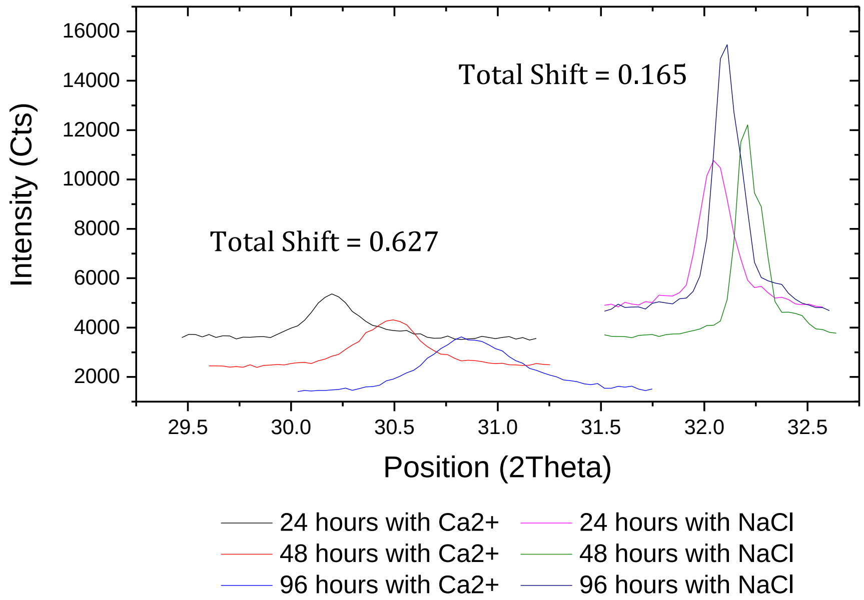
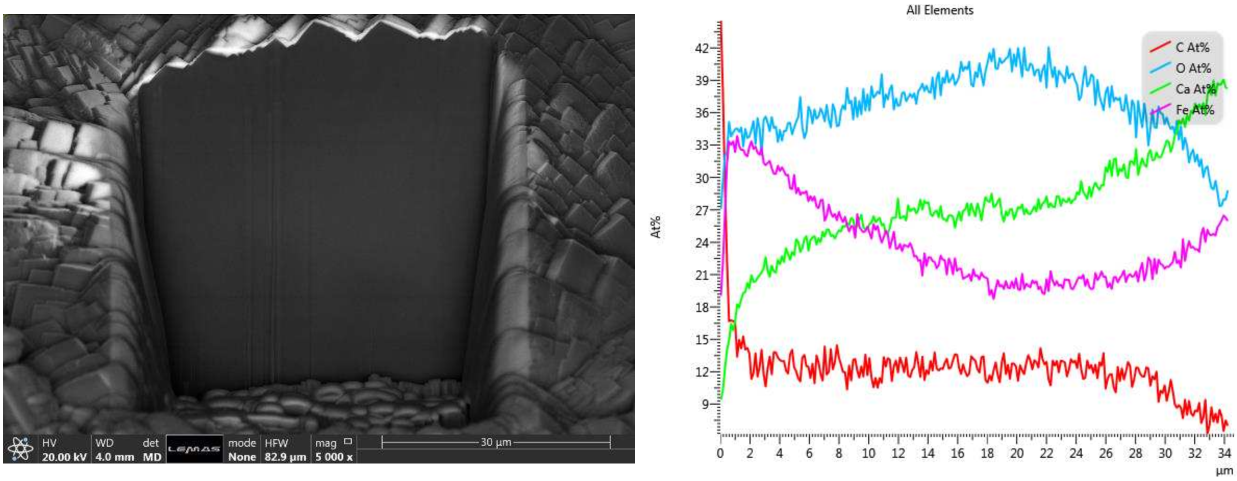
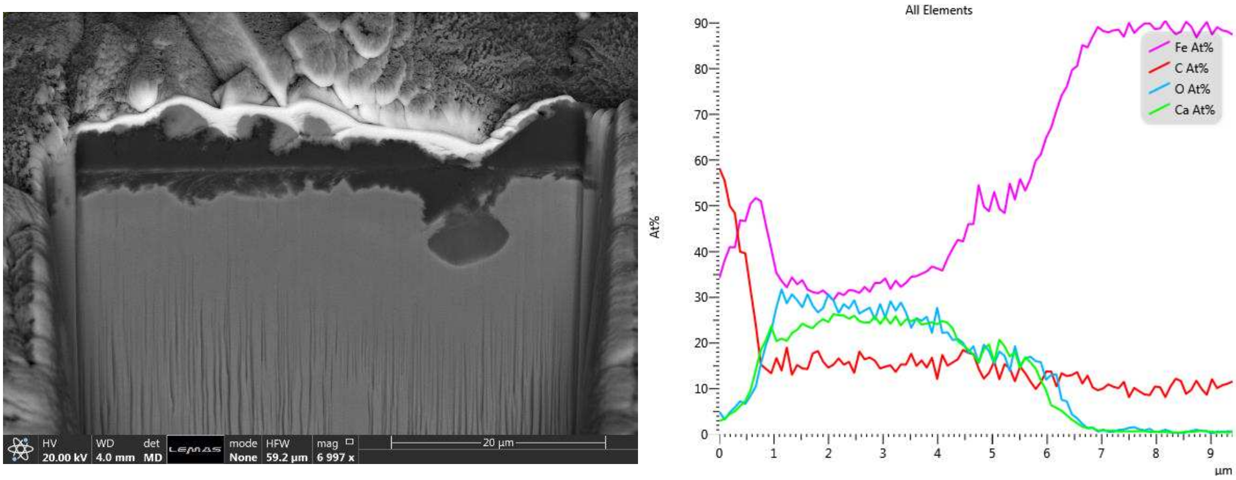


Figure 11: XRD patterns for X65 steel samples exposed to a CO_2-saturated solution containing either 3 wt.% NaCl or 1.54 wt.% NaCl with 1.83 wt.% $CaCl_2 \cdot 2H_2O$ at 80°C after 24, 48 and 96 h of exposure



(a)



(b)

Figure 12: FIB section and EDX line scan of cross-section of X65 carbon steel after exposure to a CO_2-saturated 1.54 wt. % NaCl solution with 1.83 wt.% $CaCl_2 \cdot 2H_2O$ after (a) 96 h at 80˚C and (b) 96 h at 150˚C

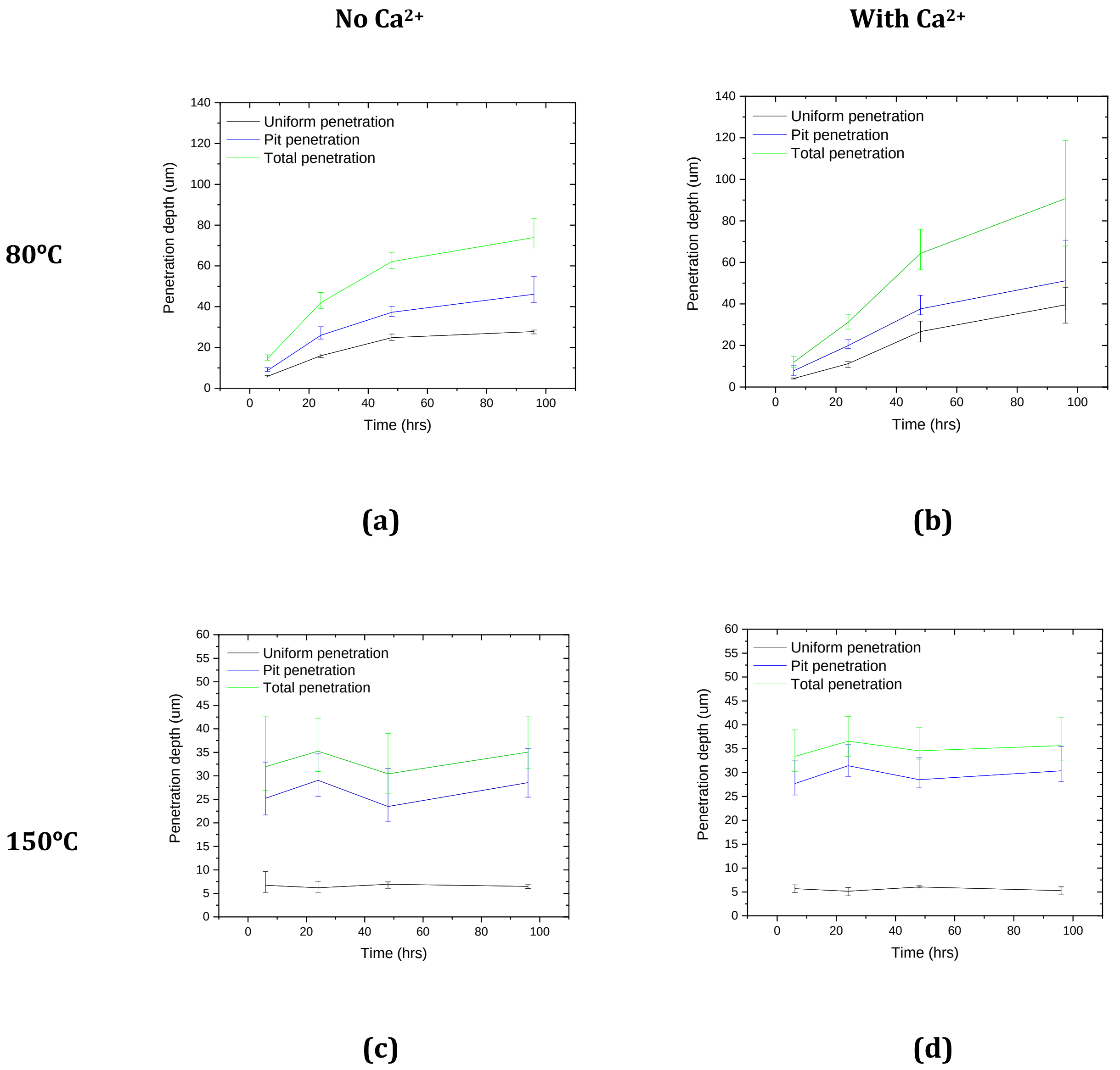
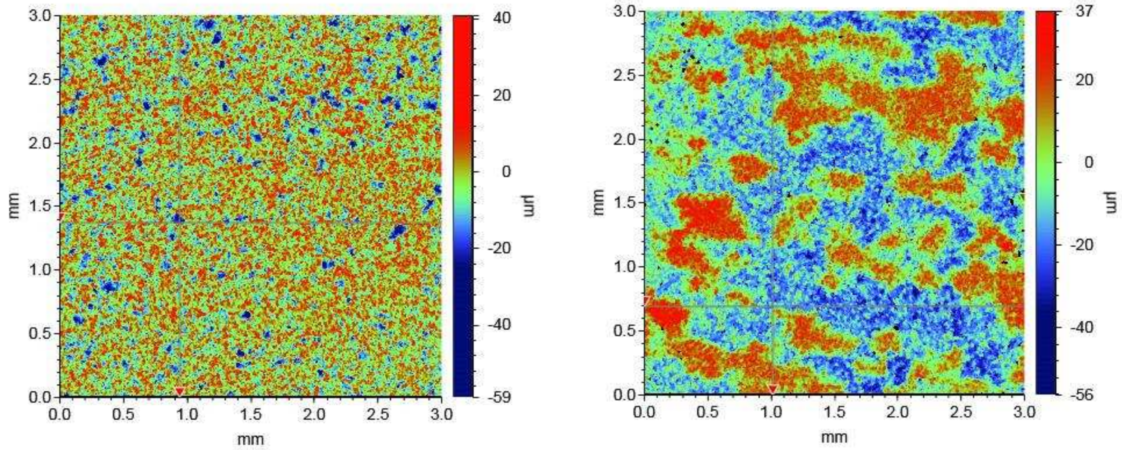
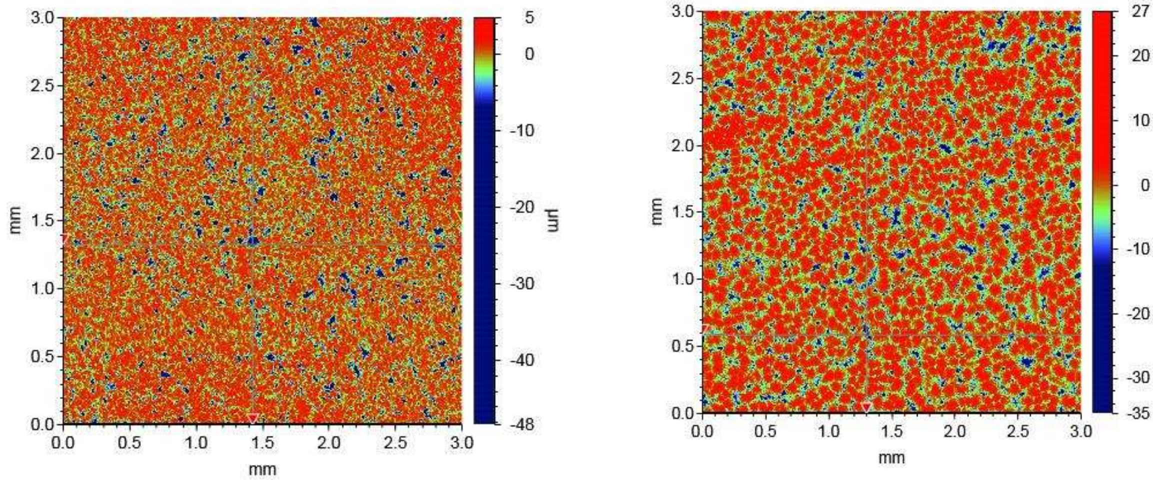


Figure 13: Uniform thickness loss (calculated from mass loss measurements), average of the top 10 pit depths relative to the corroded steel surface (from profilometry analysis) and total penetration depth (summation of the two aforementioned measurements) on X65 carbon steel as a function of time for a CO_2-saturated solution containing (a) 3 wt.% NaCl at 80°C; (b) 1.54 wt.% NaCl and 1.83 wt.% $CaCl_2 \cdot 2H_2O$ at 80°C; (c) 3 wt.% NaCl at 150°C; (d) 1.54 wt.% NaCl and 1.83 wt.% $CaCl_2 \cdot 2H_2O$ at 150°C



(a) **(b)**

Figure 14: Surface profilometry images of carbon steel surfaces after exposure to a CO_2-saturated solution for 96 h at 80˚C containing (a) 3 wt.% NaCl and (b) 1.54 wt.% NaCl and 1.83 wt.% $CaCl_2 \cdot 2H_2O$. Images are acquired after removal of the corrosion product layer



(a) **(b)**

Figure 15: Surface profilometry images of carbon steel surfaces after exposure to a CO_2-saturated solution for 96 h at 150˚C containing (a) 3 wt.% NaCl and (b) 1.54 wt.% NaCl and 1.83 wt.% $CaCl_2 \cdot 2H_2O$. Images are acquired after removal of the corrosion product layer