

Table S1. The summary of corrosion-related failures from 2000-2022.

Material	Failed product	Service environment	Failure location and detail	Failure cause	Ref.
Cast CD4MCu	Valves	Seawater circulating thorough the valves; the pressure was 69 bar and the temperature is 40-45°C.	Failure location: Matrix Failure details: Pin holes were detected after 15 years' service	Pitting corrosion at the austenite-ferrite interfaces	[1]
UNS S32760	Pipe for oil and gas transportation in oil industry	Seawater outside at room temperature outside the pipe.	Failure location: Weldment Failure details: Failure was found only 1 month after the platform start-up	Pitting corrosion due to sigma phase precipitation	[2]
UNS S32750	Flange in a discharge water line of an offshore platform	Seawater at 40°C with 1.0 kgf/cm ² of pressure.	Failure location: Weldment Failure details: Severe corrosion internal and external the flange	Pitting corrosion due to non-metallic inclusions	[3]
A351 CN3MN	Ball valve for draining cooling water in nuclear Industry	Seawater above 20°C inside and seawater at room temperature outside.	Failure location: Matrix Failure details: Leakage was found when the pipe fails to drain the cooling water	Pitting corrosion	[4]
0Cr22Ni5Mo3N	Heat exchange tube in oil industry	The internal medium is oil and gas containing hydrogen sulfide, chloride ions and water at 80°C.	Failure location: Matrix Failure details: Leak point in the expansion joint area of the pipe head after 2 months service	Pitting corrosion	[5]
DSS according to ASTM A 789	Tubes in oil industry	Internal tube contains 1 M% CO ₂ , 0.21 ppm bar H ₂ S, 120000 ppm chloride at 160°C.	Failure location: Matrix Failure details: Witnessed pitting along all the tubes	Pitting corrosion due to salts and chloride deposition during stagnant conditions	[6]
UNS S32760	Pump assembled on the offshore platform	Seawater at ambient temperature flows outside the pump.	Failure location: Matrix Failure details: The first pump was severely corroded.	Crevice corrosion at the bolt joint and the wear ring.	[7]
UNS S31803	Distillation column in chemical industry	The process fluid contains 80% acetic acid.	Failure location: Weldment Failure details: Extensive corrosion was found after a few months.	Selective corrosion with preferential dissolution of austenitic phase	[8]
UNS S32760	Flange in oil industry	Seawater at 28°C on average and 1137 KPa of pressure flows inside.	Failure location: Matrix Failure details: Selective corrosion of ferrite was found after five years' service.	Microbiological induced corrosion (MIC)	[9]
UNS S32205	Pipe in a yacht of shipbuilding industry	Seawater at 18°C	Failure location: Matrix Failure details: Extreme high corrosion rate and preferential corrosion of austenite after launching for 3 months	MIC by SOB and SRB	[10]
UNS S32900	Valve stem in a heavy water plant of nuclear	The valve operated in moist H ₂ S environment (pH=4) at 128 °C. The	Failure location: Matrix Failure details: A long	Environmental assisted cracking:	[11]

	industry	pressure is 19 kg/cm ² .	longitudinal crack was found after 30 years' years.	Sulphide stress cracking due to hydrogen embrittlement of ferrite	
UNS S32750	Reaction vessel for striping vinyl chloride monomer in chemical industry	The medium contains potable water, trace amounts of hydrochloric acid, chloride, hydrogen peroxide and calcium hydroxide.	Failure location: Weldment Failure details: Visual cracking in many circumferential and longitudinal shell welds.	Environmental assisted cracking: Stress corrosion cracking Environmental assisted cracking: Sulphide stress cracking facilitated by high weld hardness levels and local dilution of chemistry in the weld	[12]
2205	Heat exchanger	The medium was H ₂ S at ambient temperature at nearly atmosphere pressure.	Failure location: Weldment Failure details: Dissimilar weld cracked within hours after been placed into service.	Environmental assisted cracking: Stress corrosion cracking due to pitting and thermal history	[13]
Superduplex stainless steel	Valve in seawater desalination Industry	The valve operated in technical waters with high chloride content (130 mg/l). The operating temperature is up to 80°C. The pH is around 6.	Failure location: Weldment Failure details: Leakage after 2 years exposure.	Environmental assisted cracking: Hydrogen-induced stress cracking	[14]
UNS S32760	Subsea components in subsea production equipment	The parts were subjected to cathodic potential in seawater.	Failure location: Matrix Failure details: Cracking along the swaged part.	Environmental assisted cracking: Stress corrosion cracking in white liquor environment	[15]
2205	Hot white liquor accumulator in papermaking industry	Hot sulfide-containing caustic solution at about 140°C.	Failure location: Weldment Failure details: Cracks were visible near circumferential welds that failed in less than 3 months.	Environmental assisted cracking: Stress corrosion cracking due to the formation of hydrochloric acid.	[16]
2205	Reactor in chemical industry	HCl gas flows inside the reactor at about 100°C. The pressure is 0.3 MPa. Water has leaked into the reactor.	Failure location: Weldment Failure details: Periodic inspection revealed multiple cracks in the weld.	Environmental assisted cracking: Stress corrosion cracking associated with chloride	[17]
2507	Polymer heater in chemical industry	The medium in the tube is a polymerization solution containing 10-60 mg chloride. The temperature is from 70-210°C. The pressure is above 1 MPa.	Failure location: Matrix Failure details: Severely cracking after operating for some time	Environmental assisted cracking: Stress corrosion cracking associated with ferrite	[18]
SAF2205	Heat exchange pipe	A mixed gas about 145°C passed through the tube, containing carbon dioxide, sulfur dioxide and water. The internal pressure is 1.92 MPa. The external medium is circulating	Failure location: Matrix Failure details: Leakage occurred at the cooling water outlet after 3 months' service.		[19]

		water of 170 kPa at 23 °C.			
—	Crude oil pipeline in oil industry	Crude oil containing 0.8% H ₂ S, 2.64% CO ₂ , 130 g/l chloride, pH=6. The operating temperature is from 150-230 °C.	Failure location: Matrix Failure details: Cracks on the inner wall of the expansion joint after half a year of operation	Environmental assisted cracking: Sulphide stress cracking propagating preferential along ferrite phase	[20]
—	Tower overhead air cooler in oil industry	Wet hydrogen sulfide containing chloride	Failure location: Weldment Failure details: Cracks and leaks in welds and heat affected zone after a period of operation	Environmental assisted cracking: Sulphide stress cracking associated with higher ferrite content.	[20]
Cast UNS J93372	Suction roll in papermaking industry	The paper web through the roll nip	Failure location: Matrix Failure details: Circumferential cracking in the middle of the roll	Environmental assisted cracking: Stress corrosion cracking	[21]

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