TABLE 1. GALVANIC CURRENT AND POTENTIAL MEASUREMENTS AT 4 °C

Galvanic Couple (Anode/Cathode)	Area Ratio	Couple Potential (mV)	Galvanic Current Density (μA/cm²)
Al/Type 316L SS	1:1	-757.2	105.7
Al/Type 316L SS	10:1	-784.0	165.9
Al/NAB	1:1	-557.4	142.1
Al/NAB	10:1	-703.2	171.0
Al/SD255	1:1	-593.6	193.2
Al/SD255	10:1	-518.9	276.1
NAB/Type 316L SS	1:1	116	-1.705
NAB/Type 316L SS	10:1	134.7	-14.47
NAB/SD255	1:1	163.1	-64.29
NAB/SD255	10:1	185.3	-38.88

TABLE 2. GALVANIC CURRENT AND POTENTIAL MEASUREMENTS AT 24 °C

Galvanic Couple (Anode/Cathode)	Area Ratio	Couple Potential (mV)	Galvanic Current Density (μA/cm²)
Al/Type 316L SS	1:1	-774.8	148.9
Al/Type 316L SS	10:1	-698.8	123.9
Al/Type 316L SS	1:10[(A)]	-356.0	391.9
Al/NAB	1:1	-557.4	142.1
Al/NAB	10:1	-708.2	129.9
Al/NAB	1:10[(A)]	-482.6	486.0
Al/SD255	1:1	-431.3	224.0
Al/SD255	10:1	-532.5	223.4
Al/SD255	1:10[(A)]	-328.8	699.7
NAB/Type 316L SS	1:1	42.62	-1.189
NAB/Type 316L SS	10:1	-94.40	0.913
NAB/SD255	1:1	277.3	-89.50
NAB/SD255	10:1	31.90	-93.84
NAB/ D255	1:10	177.3	-36.81

[(A)]1:10 ratio tests were performed only at 24 °C.

the galvanic corrosion of aluminum changed only very slightly with an increasing aluminum anode area. These results indicate that the galvanic corrosion of the aluminum anode in this system is primarily cathodically controlled. Thus, larger sacrificial aluminum anodes are recommended in this scenario.

Galvanic currents in many situations are proportional to the surface area of the cathode. In this study, the galvanic corrosion of aluminum increased with a higher cathode (SD255).

Galvanic corrosion testing showed that there is no significant galvanic effect between SD255 and NAB. Similarly, no significant galvanic corrosion occurred between Type 316L SS and NAB. This outcome indicates that the galvanic effect does not influence the corrosion of NAB observed in seawater.

Conclusions

1. Relative CDs measured at an anode/cathode area ratio of 10:1 were not significantly higher than the currents measured at an anode/cathode area ratio of 1:1.
2. Aluminum anodes (1000 series) coupled with SD255, at 4 °C and 24 °C, and aluminum anodes coupled with NAB, at 4 °C, exhibited higher galvanic corrosion CDs compared to aluminum coupled with Type 316L SS.
3. No significant galvanic corrosion was observed between SD255 and NAB. Similarly, no significant galvanic corrosion occurred between Type 316L SS and NAB.
4. Test results indicate that the galvanic corrosion of the aluminum anode in this system is primarily cathodically controlled. Thus, larger sacrificial aluminum anodes are recommended in this scenario.

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TABLE 3. GALVANIC CORROSION RATE AT 4 °C AND 24 °C

Galvanic Couple (Anode/Cathode)	Area Ratio	Galvanic Corrosion Rate (mm/year) at 4 °C	at 24 °C
Al/Type 316L SS	1:1	1.9	2.7
Al/Type 316L SS	10:1	2.3	3.0
Al/NAB	1:1	2.6	2.8
Al NAB	10:1	2.1	3.1
Al/SD255	1:1	3.5	4.1
Al/SD255	10:1	3.6	4.1
NAB/Type 316L SS	1:1	0.00	0.01
NAB/Type 316L SS	10:1	0.20	0.00
NAB/SD255	1:1	0.00	0.00
NAB/SD255	10:1	0.00	0.00

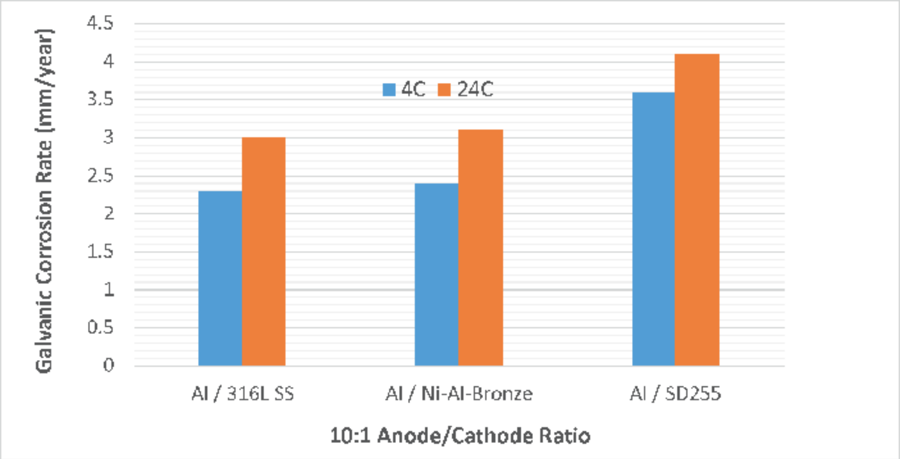

FIGURE 4 Galvanic corrosion rates with anode/cathode ratio of 10:1.