Supporting Information for

Corrosion by Aqueous Piperazine at 40-150 °C in Pilot Testing of CO_2 Capture

*Ching-Ting Liu, Kent B. Fischer, and Gary T. Rochelle**

The University of Texas at Austin, McKetta Department of Chemical Engineering. 200 E Dean Keeton St. Stop C0400, Austin, TX 78712, USA.

*Corresponding author

Email: gtr@che.utexas.edu

Tel.: +01-512-471-7230; fax: +01-512-471-7060

Corrosion Coupon Mounting Hardware

Several types of coupon mounting hardware were used at the pilot scale. WL probes on the stripper skid used a retractable probe that holds two strip coupons. This WL probe is illustrated in Figure , which also shows the compression fitting that allows the probe to be inserted and retracted.

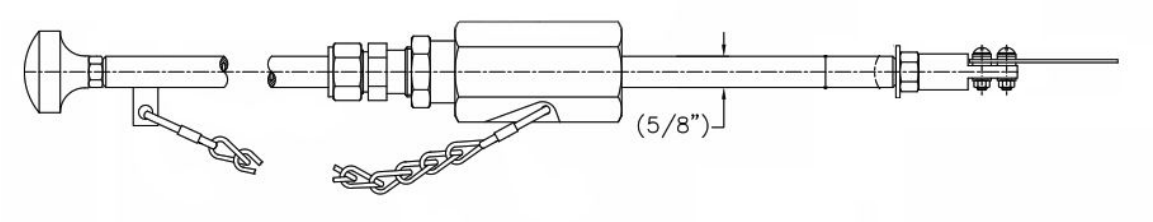

Figure S1. Illustration of the WL probes used on the stripper skid (Metal Samples Company, 2019). Each probe holds two strip coupons.

Coupons were also inserted at several locations using a retractable probe that holds four disc coupons. This hardware was used in the cold lean stream and several locations in the absorber. The probe body is similar to Figure , but the coupon adapter holds disc coupons, as shown in Figure .

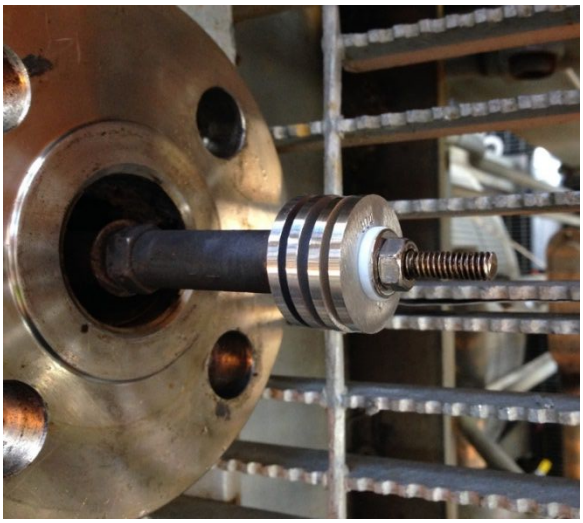

Figure S2. WL probe used on legacy NCCC equipment. Each probe holds four disc coupons.

At some locations in the absorber, coupons were mounted at ER probe locations. This is accomplished using a simple adapter that allows strip coupons to be attached to the end of ER probes. The coupon adapter is shown in Figure .

Figure S3. Coupon adapter for ER probes holding two strip coupons.

An ER probe and a coupon probe inserted into a process vessel at a pilot plant are shown in **Figure**. Both pieces of equipment can be retracted, isolated, and removed during plant operation. This is accomplished by retracting the probe through a compression

fitting, then closing a process isolation valve, then depressurizing and draining the probe mounting hardware, and finally removing the probe.

Figure S4. An ER probe and a coupon probe inserted into a vessel at a pilot plant.

Conditions and Results of Corrosion Measurements at the NCCC Pilot Plant

Table S1. Summary table of corrosion measurements in the absorber at the NCCC pilot plant

Campaign	Location	Batch Descriptor	Batch operating hours	Approx. Temperature (°C)	Mean velocity (m/s)	Corrosion rate (μm/yr)		
						316L	304	C1010
NCCC 2018	Absorber sump	2	388	50	0	0.5		0.9
		3	879	50	0		0.1	0
		4	363	50	0	0.6		0.6
	Bed 1-2	2	388	50	0			
		3	879	50	0	0.1		0.3
		4	363	50	0	0.5		0.2
	Absorber top	2	388	50	0			
		3	879	50	0			5
		4	363	50	0			
	Cold lean	2	388	50	0.50			
		3	879	50	0.50	0.4		108
		4	363	50	0.50	1		210
NCCC 2019	Absorber sump	-	1979	50	0	0		298
	Bed 1-2	-	1979	50	0	0.5		278
	Bed 2-3	-	1979	50	0	0.2	0.5	0.8
	Absorber top	-	1979	50	0	0.2	0.2	0
	Cold lean	-	1979	50	0.36	0.0	18	140

Table S2. Summary table of corrosion measurements in the Advanced Stripper at the NCCC pilot plant

Campaign	Location	Batch descriptor	Batch operating hours	Temperature (°C)	Mean velocity (m/s)	Qualitative Loading	Corrosion rate (μm/yr)					
							316L	304	C1010	2205	C276	I625
NCCC 2018	Hot lean	2	388	146	0.53	lean	1095					
		3	879	149	0.43	lean		0.5	711			
		4	363	146	0.54	lean	1.8		49			
	Hot rich[i]	2	388	152	0.87	lean	629		184			
		3	879	154	0.73	lean		198	36			
		4	363	151	0.91	lean	1.9		2729			
	Warm bypass	2	388	116	0.26	rich	9.0		9621			
		3	879	116	0.21	rich		0.3	55			
		4	363	117	0.27	rich	1.2		47			
	Cold bypass	2	388	48	0.05	rich	0.7		92			
		3	879	50	0.05	rich		0.0	97			
		4	363	50	0.05	rich	1.0		50			
	Stripper sump	2	388	147	0.00	lean	489		103			
		3	879	149	0.00	lean		0.6	0.2			
		4	363	146	0.00	lean	4.4		11			
NCCC 2019	Hot lean	1	225	150	0.44	lean	711			0.6	464	604
		2	390	139	0.60	lean		11	910		314	397
		3	400	150	0.55	lean	1429			1.0		
		4	964	150	0.54	lean	0.0	0.8		0.5		
	Hot rich[i]	1	225	154	6.46	lean	597			0.0	433	656
		2	390	144	5.72	lean		10	7431		0.0	0.0
		3	400	153	4.83	lean	417	0.1	4463	0.0		
		4	964	152	4.83	lean	0.0	0.0		0.0		
	Warm bypass	1	225	112	0.25	rich	112			0.0	137	86
		2	390	111	0.30	rich		0.0	107		0.9	0.9
		3	400	112	0.24	rich	223	0.7	143	0.7		
		4	964	113	0.24	rich	0.0	1.3	11	1.1		
	Cold bypass	1	225	45	0.03	rich	0.2			0.4	0.1	0.1
		2	390	45	0.05	rich	0.6	0.5	291			
		3	400	46	0.03	rich	0.5	0.0	50			
		4	964	46	0.03	rich	1.3	1.8				
	Stripper sump	1	225	151	0.00	lean				0.3	318	
		2	390	140	0.00	lean		1.0				186
		3	400	150	0.00	lean			0.0	1.1		
		4	964	150	0.00	lean	0.0	0.3				

[i]The hot rich stream was flashing, and part of the CO_2 was in the gas phase; therefore, the liquid phase had a CO_2 loading in the "lean" region.