

Multifunctional Rooftop Unit for Direct Air Capture

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Face Velocities

Results for the face velocities are shown in Table S1. The data were measured at the centers of 56 cells superimposed on the outdoor coil face. A wide range of velocities was measured because of variations in the pressure drop created across the coil by the outdoor fan mounted on the top of the RTU. Additionally, the RTU was approximately 10 years old at the time of this test, with resulting loading of debris between fins unevenly across the coil and coil damage due to hail. Measuring the face velocity with the RTU was challenging because of the prevailing winds on the roof. Lastly, although 90 modules were installed on the north face during DAC testing, the face was divided into 56 equal rectangles for air speed measurement because the cross-sectional area of the modules was not yet decided when the face velocity measurements were taken.

Table S1. Heat map of face velocity measurements from 56 cells on the north face of the outdoor coil without modules installed. Yellow cells contain the lowest face velocities, and green cells contain the highest.

Face velocity in meters per second								
	1	2	3	4	5	6	7	8
1	1.19	1.07	0.51	1.17	1.24	1.01	1.22	1.24
2	0.89	0.61	0.91	1.30	1.35	0.98	1.02	0.97
3	1.12	1.09	0.81	0.91	0.76	0.93	1.02	0.97
4	0.81	1.02	0.71	0.61	1.02	0.53	0.62	0.51
5	1.27	0.71	0.94	1.05	0.86	0.74	1.03	0.89
6	0.86	0.64	0.61	0.91	0.66	0.78	0.77	0.91
7	0.56	0.34	0.48	0.61	0.71	0.64	0.70	0.56

Table S2. Residence time for the 56 cells on the north face of the outdoor coil without modules installed. (Velocity data in Table S1).

	1	2	3	4	5	6	7	8
1	0.043	0.048	0.100	0.043	0.041	0.051	0.042	0.041
2	0.057	0.083	0.056	0.039	0.038	0.052	0.050	0.053
3	0.045	0.047	0.063	0.056	0.067	0.054	0.050	0.053
4	0.063	0.050	0.071	0.083	0.050	0.095	0.082	0.099
5	0.040	0.071	0.054	0.048	0.059	0.069	0.050	0.057
6	0.059	0.080	0.083	0.056	0.077	0.065	0.066	0.056
7	0.091	0.149	0.105	0.083	0.071	0.080	0.073	0.091

Measurement of CO₂ Upstream and Downstream of the Modules as Installed.

The difference in CO₂ concentration between the upstream and downstream CO₂ meters was expected to demonstrate the capability of the PAN-TETA to remove CO₂ from the ambient air. Carbon dioxide concentrations were measured upstream and downstream of the PAN-TETA modules (and the outdoor coil of the RTU) for several weeks, and the differences are shown in Figure S1. The PAN-TETA modules were installed on the RTU only during the times indicated between the orange bars. Therefore, the upstream and downstream measurement of CO₂ was not a method to observe the effect of CO₂ absorption. However, results from the TGA of small samples extracted from multiple PAN-TETA modules conclusively demonstrated that CO₂ was captured by the PAN-TETA material during the weeks of operation.

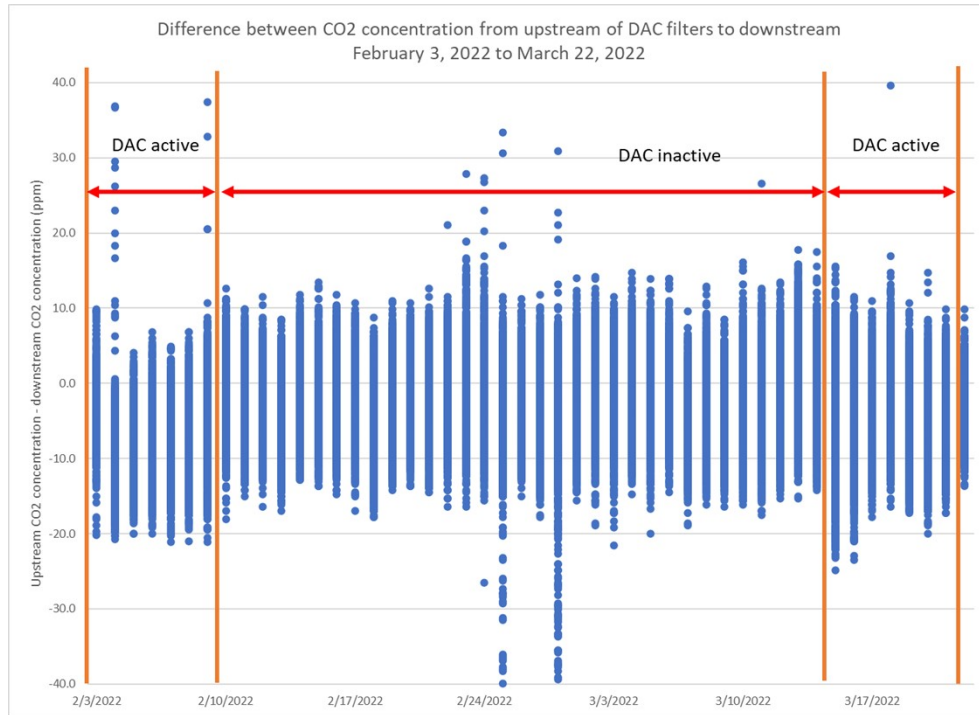


Figure S1. Differences between CO₂ concentrations from upstream and downstream of DAC filters from February 3, 2022, to March 22, 2022. Dots represent measurements taken at 30 s intervals.

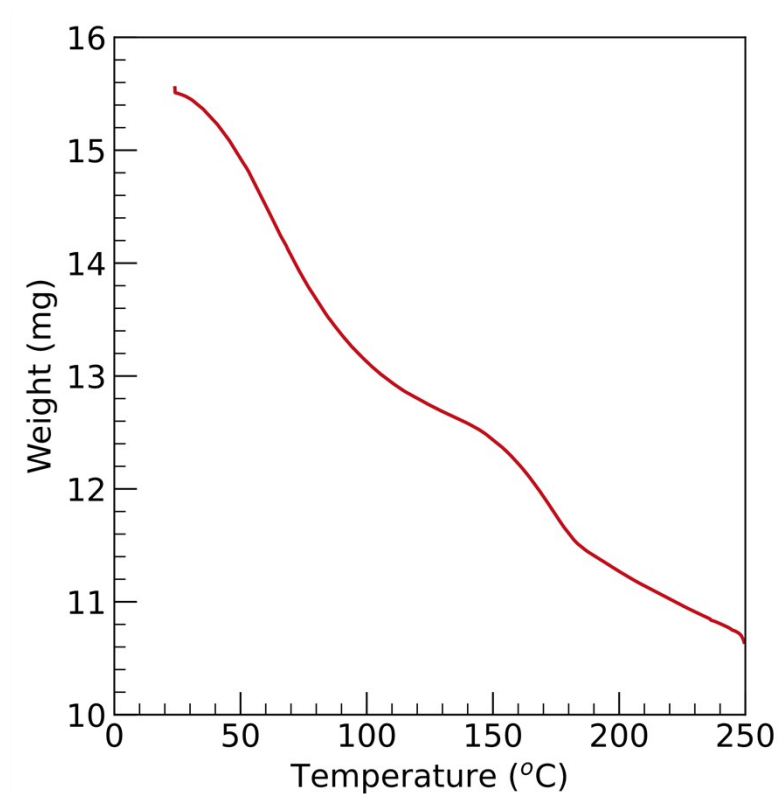


Figure S2. Selected TGA data in TGA-MS measurement.