CO_2 Removal Systems for Advanced Space Exploration

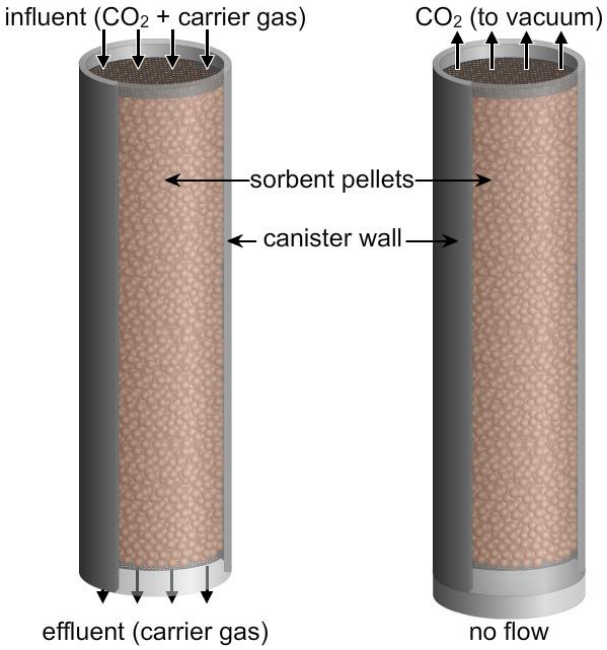
Karen Son, J.A. Weibel, S. V. Garimella

Objective

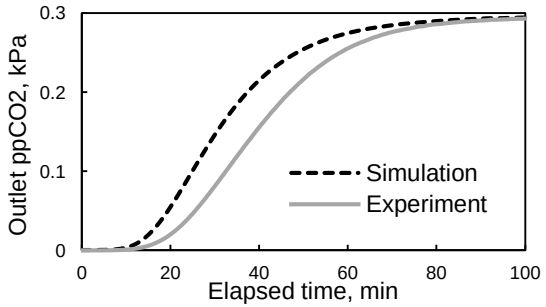
Improve predictions of the physical properties of porous materials through more accurate physical models, to enable the design of life support systems for deep space exploration missions.

Approach

- Develop reduced-order model of CO_2 flow through a packed bed of sorbent pellets
- Experimentally measure adsorption/desorption rates in packed, sorbent pellet bed
- Determine sources of model inaccuracy by comparing with experiments to then develop better *a priori* predictions of physical properties



Schematic drawing of a cylindrical test bed packed with spherical sorbent pellets during: (a) adsorption and (b) vacuum desorption.



Comparison of experimental partial pressure of CO_2 at bed outlet with 2D simulation for (adsorption) breakthrough test.

Impact

- Improved predictive modeling tools for adsorption/desorption of CO_2 in packed beds
- Enable simulation-based design and optimization of the next generation of sorbent-based CO_2 removal systems for our journey to Mars

Selected Publications

Son, K., Paragano, M., Gomez, C., Knox, J. 46th International Conference on Environmental Systems (ICES), 2016.

Acknowledgements

Thanks to Jim Knox and Robert Coker for their collaboration and guidance. Support for this research was provided by the NASA Space Technology Research Fellowship (NSTRF) Grant No. NNX13AL55H.

PURDUE UNIVERSITY

NASA

COOLING TECHNOLOGIES RESEARCH CENTER