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C1Po1D-03 [27]: Oxygen Separation in a Vortex Tube with Applied Magnetic Field

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The large scale and efficiency of air separation units remain key barriers towards modular, distributed liquid oxygen systems. Identifying new physical separation mechanisms, or novel combinations of established methods, could enable the development of smaller, more modular air separation systems. In this paper we investigate the combination of centrifugal separation with paramagnetism of liquid oxygen in a vortex tube. The magnetic field is applied via externally mounted 1.5 T bar magnets along the length of the hot end of the vortex tube. Various calibrated air and argon-oxygen mixtures are tested. Inlet vortex tube fluid conditions are varied from 80-90 K and 303.4-337.8 kPa. Gas chromatography analysis on the calibrated air samples shows the magnetic field gradient on the vortex tube produced a 68% increase in oxygen separation compared to the non-magnetic trials. Comparisons are made to competing oxygen separation methods. The results indicate a potential to increase oxygen purity and yield in a more compact form factor.

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