

Methane Post-Processor Development to Increase Oxygen Recovery beyond State-of-the-Art Carbon Dioxide Reduction Technology

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State-of-the-art life support carbon dioxide (CO₂) reduction technology, based on the Sabatier reaction, is theoretically capable of 50% recovery of oxygen from metabolic CO₂. This recovery is constrained by the limited availability of reactant hydrogen. Post-processing of the methane byproduct from the Sabatier reactor results in hydrogen recycle and a subsequent increase in oxygen recovery. For this purpose, a Methane Post-Processor Assembly containing three sub-systems has been developed and tested. The assembly includes a Methane Purification Assembly (MePA) to remove residual CO₂ and water vapor from the Sabatier product stream, a Plasma Pyrolysis Assembly (PPA) to partially pyrolyze methane into hydrogen and acetylene, and an Acetylene Separation Assembly (ASepA) to purify the hydrogen product for recycle. The results of partially integrated testing of the sub-systems are reported.