CO oxidation assessment of a new commercial catalyst for NASA environmental control and life support safety applications

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Abstract: Growth of research in outer space calls for continued evaluation of spacecraft safety systems. NASA currently uses a catalyst developed by TDA Research, Inc in the contingency breathing apparatus and Orion smoke eater filter to eliminate carbon monoxide (CO) released during fire events in the Orion Multi-Purpose Crew Vehicle (MPCV). The release of Astrea Materials, a commercial gold-titania catalyst comparable to TDA, prompted NASA to investigate the optimal material for CO removal in the MPCV. In this study, the Astrea catalyst was evaluated by measuring CO removal efficacy. Experiments involved 1000 ppm of CO being flowed with zero air through a fixed-bed reactor. Experimental variables were gas hourly space velocity (GHSV), relative humidity (RH), and catalyst temperature (T). CO removal exceeded 97% at 2.7×10^4 h^{-1}, regardless of T. Catalyst efficiency significantly decreased at higher GHSVs, 1.1×10^5 h^{-1} and 1.6×10^5 h^{-1}, with CO removal approaching 50% due to lower catalyst contact time. Reaction kinetics confirmed an Arrhenius relationship: raising T increased CO removal. For GHSVs above 2.7×10^4 h^{-1}, increasing T from 0 to 25 °C increased CO removal by over 25%. RH significantly decreased catalyst performance at higher GHSVs, 1.1×10^5 h^{-1}, with a drop from 79.7% removal at 15% RH to 66.4% at 85% RH. Astrea performs well at low GHSVs and 0% RH and activity was reduced outside those conditions. Identical experiments will be repeated with TDA to compare catalyst efficiency and resilience. The poster will discuss catalytic capabilities of TDA and Astrea in CO removal for the MPCV.