

Influence of Oxygenated Compounds on Reaction Products in a Microwave Plasma Methane Pyrolysis Assembly for Post-Processing of Sabatier Methane

The state-of-the-art Carbon Dioxide Reduction Assembly (CRA) was delivered to the International Space Station (ISS) in April 2010. The system is designed to accept carbon dioxide from the Carbon Dioxide Removal Assembly and hydrogen from the Oxygen Generation Assembly. The two gases are reacted in the CRA in a Sabatier reactor to produce water and methane. Venting of methane results in an oxygen resupply requirement of about 378 lbs per crew member per year. If the oxygen is supplied as water, the total weight for resupply is about 476 lb per crew member per year. For long-term missions beyond low Earth orbit, during which resupply capabilities will be further limited, recovery of hydrogen from methane is highly desirable. For this purpose, NASA is pursuing development of a Plasma Pyrolysis Assembly (PPA) capable of recovering hydrogen from methane. Under certain conditions, water vapor and carbon dioxide (nominally intended to be separated from the CRA outlet stream) may be present in the PPA feed stream. Thus, testing was conducted in 2010 to determine the effect of these “oxygenated” compounds on PPA performance, particularly the effect of inlet carbon dioxide and water variations on the PPA product stream. This paper discusses the test set-up, analysis, and results of this testing.