Carbon Dioxide Methanation for Human Exploration of Mars: A Look at Catalyst Longevity and Activity Using Supported Ruthenium

Elspeth M. Petersen1, Anne J. Meier2, and Jean-Philippe Tessonnier1*  

2NASA, Kennedy Space Center, Florida, 32899 (USA)  
1Dept. of Chemical and Biological Engineering, Iowa State University, Ames, IA 50011 (USA), *tesso@iastate.edu

INTRODUCTION
Objective  
The remote operation of the Mars ISRU lander to produce rocket fuel prior to crew arrival on the planet to power an ascent vehicle.

Constraints  
- Long-term operation (480 days)  
- Variable conditions  
  - Feed gas flow rates  
  - Feed gas flow ratios  
  - Reactor bed temperature

CURRENT STUDY PURPOSE  
Examine supported Ruthenium as a carbon dioxide methanation catalyst to determine the effects support properties have on the active phase by studying activity and selectivity.

RESULTS  
The benchmark catalyst, 5%Ru/Al2O3, performed the best with the highest conversion and selectivity as well as the largest temperature of reduction indicating a favorable relationship between this support and the catalyst.

CONCLUSIONS  
Selection particle size improves over time – sintering of the smallest Ru particles. Overall particle size increases and some support sintering is possible but not outside possible error for BET. It is surprising that the rutile titania does not perform better as a support. Its superior performance has been documented in previous work.

REFERENCES  

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