

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Moon Exploration – Part 3 (2C)

Author: Prof. Michèle Lavagna  
Politecnico di Milano, Italy, michelle.lavagna@polimi.it

Dr. Paolo Lunghi  
Politecnico di Milano, Italy, paolo.lunghi@polimi.it

DEMONSTRATOR DESIGN FOR LUNAR IN SITU RESOURCE UTILISATION AND OXYGEN  
PRODUCTION**Abstract**

the paper discusses the activities currently on going at Politecnico di Milano to design a demonstrator plant for ISRU to extract water from Moon regolith. The Carbothermal reduction (CRB) process, solid-gas based, using methane is here preferred to contain the endothermic reaction temperatures in the range of 950-1000C. Former in house experimental activities, demonstrated the mentioned process is cost effective: almost no beneficiation is needed to obtain by far conversion efficiency higher than with other processes such as with hydrogen reduction. The reason why stays in the soil composition the most, being the CRB capable to attack the feedstock silicon oxide, representative of almost 50% However, during the methane reduction, the coke formation must be avoided to keep the whole process self-sustainable in the methane re-generation. Therefore, a low pressure reaction is preferred which increases the complexity for the reactor sealing strategy. The design here presented, while ensuring the already demonstrated process efficiency, focuses the more on the whole plant to be the more compliant with a potential inflight operational environment: alternatives on reactor automatic feeding with feedstock and gases, exhausted regolith from the CRB reactor automatic discharge, solid valves design for tight reactor sealing, thermal control to ensure the correct heat exchange at each plant stage are traded-offs and the preferred baseline is critically discussed.