From Natural Resources to Synthetic Nanomaterials: Can We Use This Technology for Sustainable Settlements?

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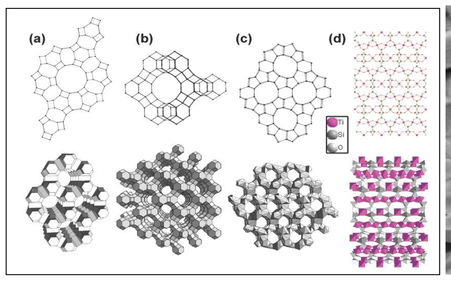
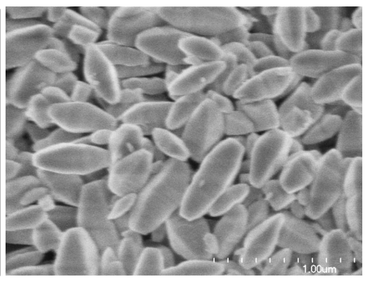
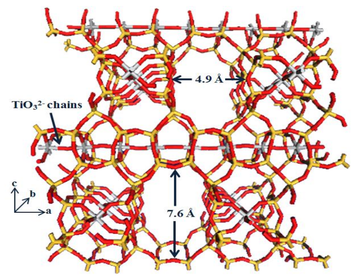
ZEOLITES: MOLECULAR SIEVES

Zeolites are solid inorganic aluminosilicates comprised of linked alumina and silica units through oxygens forming three-dimensional structures with well-defined cages and nanopores.







Zeolite Crystal Growth (ZCG) investigations had been operational since 1989. The aim has been to examine the effect of subtle changes in the chemical formulation on nucleation and growth of zeolite crystals in microgravity. Equipment and procedures were designed to safely undertake thease crystal growth experiments in space. These resulted in very successfulsc studies in microgravity on board the Space Shuttle Columbia and International Space Station (ISS). ZCG experiments were lost with space shuttle Columbia (STS-107, February 2003). Subsequent end to space shuttle flights ended the continuation of these experiments.

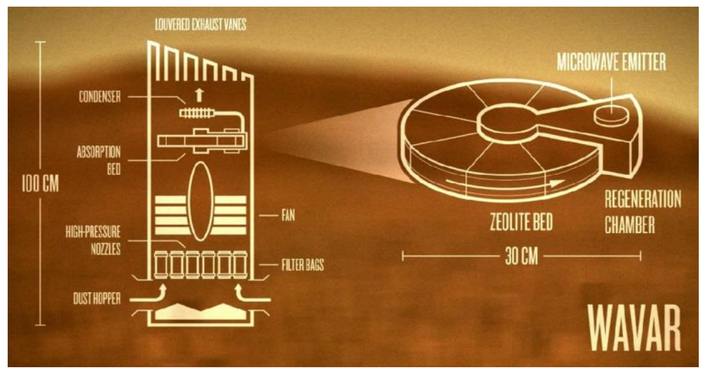
Zeolites are conventionally made from pure chemicals to obtain solutions of sodium silicate and sodium aluminate, which are mixed in appropriate proportions into form a homogeneous gel. Clay minerals have attracted a lot of attention to be used as a source of alumina and silica for production of zeolites.

MARS Rock Touched by NASA Curiosity Has Surprises

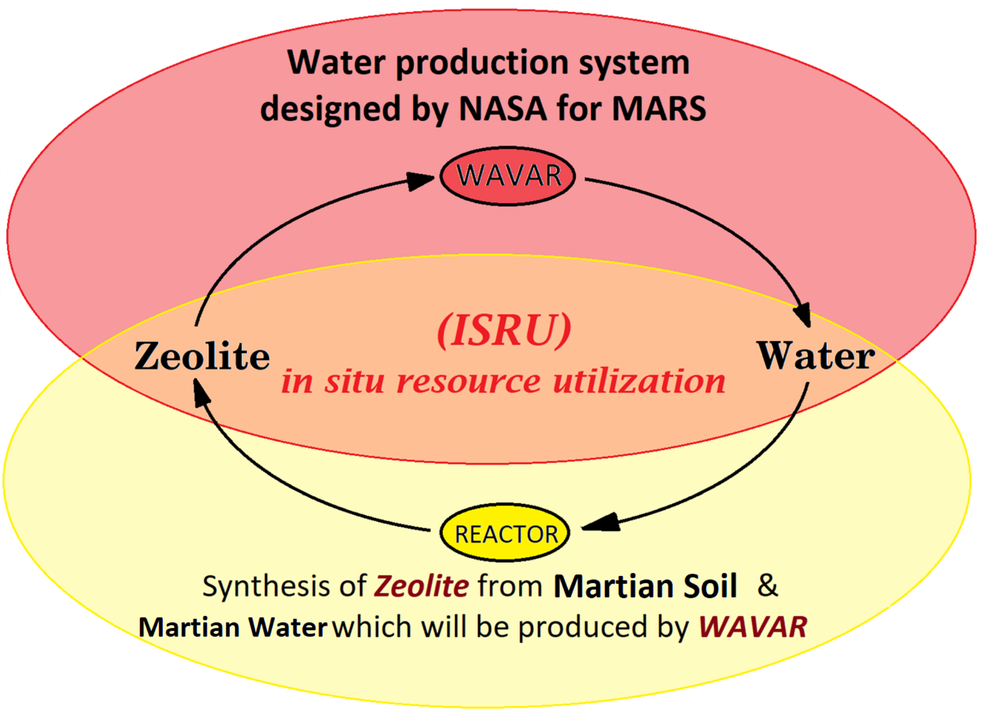
Martian meteorite and surface remote sensing observations indicate that Mars is dominated by mafic to possibly intermediate igneous compositions with no previously identified occurrences of quartzofeldspathic compositions. Jake is kind of an odd Martian rock: It's high in elements consistent with the CLAY mineral rich in alkali minerals.

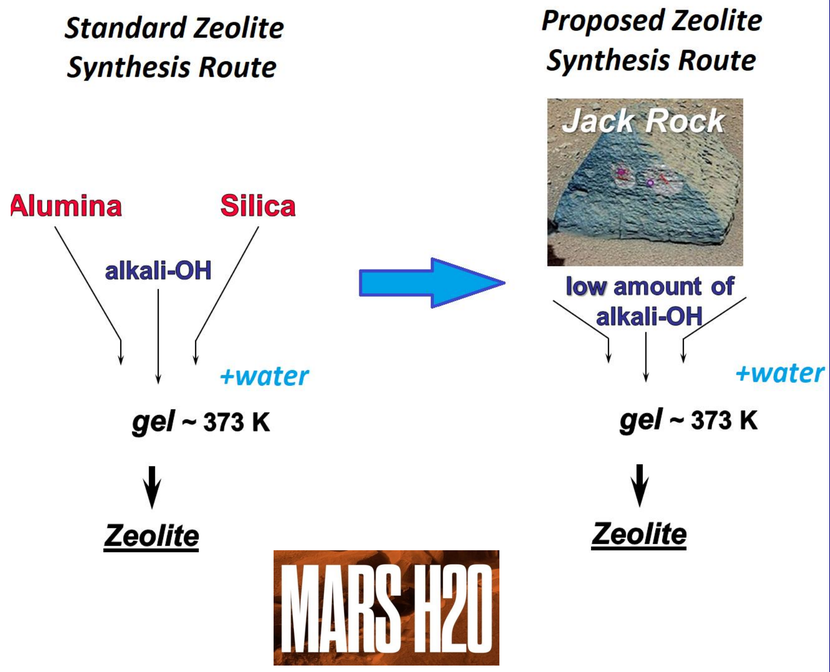
ZEOLITIC FORMATION IN MARS ENVIRONMENT: Can we Use Mars Resources?

WAVAR, short for water-vapor adsorption reactor, is a process that has been studied for its potential in directly extracting water from the athmosphere of Mars by alternately blowing air over ***Zeolite A*** adsorption bed and heating the bed to extract the adsorbed water. An advantage of this process is its mechanical simplicity and applicability to any point on Mars's surface. Its output is not sufficient for industrial purposes such as fuel manufacture, but it may be a useful supplement to life support in some architectures.



The main aim is to use the quartz-feldspathic soil of Mars as raw material for zeolite synthesis due to its high Na, Si & Al content. These minerals can be activated via alkaline fuison and converted into zeolites via hydrothermal synthesis method. The produced zeolites can be used in WAVAR to produce more water which serves for In Situ Resource Utilization (ISRU).





CONCLUSIONS

Zeolites are attactive materials for different applications from catalysis to desiccant applications. The synergy is to use the martian soil which has quartzofeldspathic minerals and convert it into zeolite via alkaline fusion, followed by hydrothermal reaction. Synthesized zeolites can be used to generate more water from martian athmosphere, which is a useful approach for in situ resource utilization (ISRU) practice.

ACKNOWLEDGEMENTS

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