

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)  
Microgravity Sciences Onboard the International Space Station and Beyond - Part 1 (6)

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STEPPING STONES TOWARD OXIDATION PROCESSES IN SUPERCRITICAL WATER

**Abstract**

Under supercritical conditions (i.e. when the temperatures and the pressures of a mixture are above its thermodynamic critical point), water becomes a fluid with unique properties that can be used to treat a wide variety of wastes. This process is referred to as SuperCritical Water Oxidation (SCWO).

Already used on ground applications (for example onboard ships), SCWO reactors are thus of great interest in the frame of the exploration programs: that kind of reactor could be used to treat wastes onboard interplanetary vehicles as well as in extraterrestrial habitats.

In the frame of the DECLIC program, the two first steps toward SCWO applications in microgravity have been negotiated. First, pure water as a supercritical fluid was studied with the HTI (High Temperature Inert) insert. The behavior of water near its critical point is now well understood. The insert was then refurbished (and called HTI-R), and launched back to the ISS with a salt-water solution (0.5

A third step will be negotiated when the HTI will be refurbished a second time in order to study another mixture (to be chosen once the HTI-R program is over).

Then, plans are to go ahead with two kinds of studies: - The "Chemical Reactions" studies will allow for the study of chemical reactions of various materials in supercritical water or high pressure gaseous environments. - The "Destruction of Wastes" studies will demonstrate the ability to recycle liquid waste streams using supercritical water oxidation processes.

Those kinds of studies are beyond the scope of the DECLIC program and new payloads will have to be developed.

After quickly presenting the DECLIC payload, the paper will summarize the results obtained with the HTI insert. Then, the mid-term (HTI new refurbishment) and long term (chemical reactions and destruction of wastes studies) objectives will be introduced.