



Investigating the Structures of Paramagnetic Aggregates (InSPACE-1) ISS On-Orbit Operations

Glenn Research Center



PT: ISS Research Project
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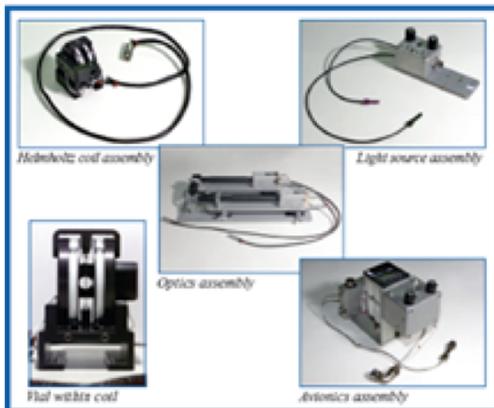
Objective: To (1) visually study the gelation transition in magnetorheological fluids (MR) under steady and pulsed magnetic fields, and (2) determine the three-dimensional low-energy (equilibrium) structure of an MR emulsion in a pulsed magnetic field.

Significance: MR fluids are a class of smart materials capable of changing visco-elastic properties. Microgravity data will provide an assessment of the viscous-elastic properties for use in new brake systems, seat suspensions, robotics and vibration damping systems.

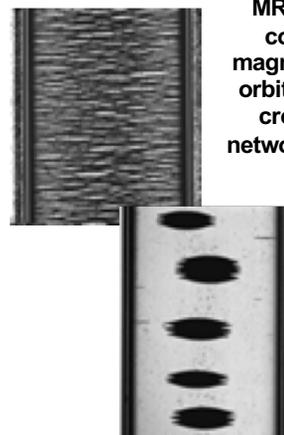
Approach: InSPACE consists of Helmholtz coil assemblies (electromagnets that produce a uniform magnetic field), each with a small borosilicate vial filled with MR fluid. Operated in the MSG, the crew installs a coil onto an optics assembly, adjusts electrical current and frequency causing the MR fluid to aggregate and form microstructures within the fluid.



Astronauts Don Petit, William McArthur, and Jeffrey Williams have performed InSPACE operations on ISS.



InSPACE hardware components



MR fluids in a continuous magnetic field on orbit develops a cross-linked network structure.

Statistics on InSPACE Operations

- InSPACE hardware and samples were launched to the ISS on 6/5/2002, and 11/23/2002 respectively.
- Primary operations occurred on ISS in Increment 7. The nominal revised test matrix was performed the week of 7/2/2003 with 26 runs / 41 test points completed.
- William McArthur successfully completed sample monitor runs to verify fluid dispersion in Increment 12 on 5/26/2006.
- Additional 5 science test runs were performed by Jeffrey Williams in Increment 13 the week of 6/5/06 including a Saturday Science run.
- Operations focused on a transition in structural configuration over a range of frequencies. Prevailing structures aligned in a columnar fashion along the magnetic field lines with elaborately shaped interfacial cross-sections.
Significant Findings to Date
- New sheet-like structures with spiny interfaces in the cross-section were observed.