



Binary Colloidal Alloy Test (BCAT-3 / BCAT-4)



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Objective:

- ◆ Determine phase separation rates and properties of model critical fluid system. BCAT-3 results push the existing theory.
- ◆ Photograph the time evolution of critical point samples onboard the International Space Station (ISS).
- ◆ BCAT-3 will studied 6 critical point samples already on the ISS.
- ◆ BCAT-4 will study 10 additional samples; 7 to add needed points to the critical point phase diagram and 3 to test properties predicted for crystallized hard spheres particles. Also testing effects of seeded crystal growth, *i.e.*, "nanodirt".

Relevance/Impact:

- ◆ Data from the BCAT-3 critical point samples indicate that the present theory for the critical behavior of fluids is incomplete when applied to this important class of samples. When the masking effects of gravity are removed, the rate that BCAT-3 critical point samples separate into two phases orders of magnitude more slowly much closer to the critical point. Testing theories that previously lacked experimental data. The crystallization of hard sphere particles in microgravity will confirm and extend the CDOT (STS-95) flight experiment finding that hard spheres may not have a glass phase. Will also look at effects of polydispersity and seeding on how order arises out of disorder.

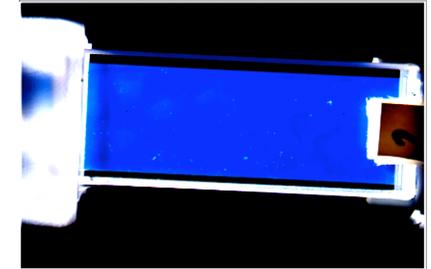
Development Approach:

- ◆ Flight design uses existing (BCAT-3) hardware design with minor modifications.
- ◆ Using EarthKAM set-up already on the ISS minimizes upmass / volume, costs, and crew supervision, while increasing the quantity and quality of the data.
- ◆ BCAT-3 completed original science ops 1/2009, in storage for follow-on science.

Glenn Research Center



Increment-12 Astronaut Bill McArthur photographing BCAT samples.



NASA Image: ISS013E26396 - Critical fluid sample 2 phase separating aboard Expedition 13.

ISS Resource Requirements

Accommodation (carrier)	ISS MWA / Seat track setup
Upmass (kg) (w/o packing factor)	0 kg (BCAT-3 already on ISS) 2.7 kg (BCAT-4 module) + batteries
Volume (m³) (w/o packing factor)	1.76 x 10 ⁻³
Power (kW) (peak)	132 Watts (laptop (90W) and camera (42W)) + 36 AA-batteries BCAT-4
Crew Time (hrs) (installation/operations)	BCAT-3, Inc. 8-18 (2.6 hrs. remain to complete) BCAT-4, Inc. 17- (26 hrs. remain to complete)
Autonomous Ops Time (hrs)	80 (BCAT-3, Inc. 8-18) 2044 (BCAT-4, Inc. 17-)
Launch/Increment	15-16 (BCAT-3), 1J/A (BCAT-4)

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	CDR	VRR	Safety	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline (BCAT-3)	N/A	N/A	N/A	N/A	N/A	Nov 2003	On ISS	On ISS	Incr. 8 ~18	Ops + 6 m	Return + 6 m
Actual/ Baseline (BCAT-4)	N/A	N/A	N/A	N/A	N/A	May 2007	Jul 2007	1J/A, 3/11/2008	17-	Ops + 6 m	Sept 2009
Documentation	Website: eRoom:				SRD: EDMP:			Project Plan: SEMP:			