



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

Binary Colloidal Alloy Test (BCAT-4)



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Objective:

- ◆ Determine phase separation rates and properties of model critical fluid system. BCAT-3 results question existing theory.
- ◆ Photograph the time evolution of critical point samples onboard the International Space Station (ISS).
- ◆ BCAT-3+ will study 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 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 show an unexpected (exponential scaling law) behavior, which seems to deviate from expected (power law scaling) behavior. The crystallization of hard sphere particles in microgravity will confirm and extend CDOT finding that hard spheres do not have a glass phase. Will also look at effects of polydispersity.

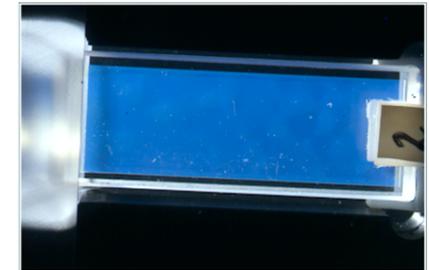
Development Approach:

- ◆ 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.

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
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)	90 Watts (laptop and camera) + 24 / 72 AA-batteries BCAT-3+ / 4
Crew Time (hrs) (installation/operations)	8 (BCAT-3+, Inc. 15-16 remain) 26 (BCAT-4, Inc. 16,17,18)
Autonomous Ops Time (hrs)	80 (BCAT-3+, Inc. 15-16, remain) 2044 (BCAT-4, Inc. 16,17,18)
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. 13-16	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, 2/14/2008	16,17,18	Ops + 6 m	Sept 2009