French micro-gravity studies for solid/liquid phase change.

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Keywords : Phase transitions – Microgravity – Interfaces – Fluid phase – Instabilities

Solid/liquid phase changes are sensitive to gravity. The main phenomena is the Rayleigh-Bénard convection. This instability is coupled to solidification front motion. The interfacial zone is often very complex to describe.
Indeed, front curvature and solid phase structure depend on several factors and it will be interesting to eliminate some of them due to gravity for a best understanding of solidification process.
Experiments in microgravity conditions are necessary, in drop towers, parabolic flight, sounding rockets and satellites. For instance, an experimental modulus, named DECLIC, will take place in the ISS. Experiments on transparent material solidification will be performed in DECLIC.
At the same time it is very useful to perform calculations with and without gravity effects.
Control process by vibration or magnetic field are sometimes required to stabilize solidification fronts.
Several teams works on these topics in the French Research Group : "Transport Phenomena and phase transitions in Microgravity" (GDR CNES/CNRS, since Januar 2004: "Fundamental and Applied Microgravity"). The activities of this teams are the following:
- Solidification from the melt (Bernard Billia)
- Solidification Fronts (Gabriel Faivre)
- Instabilities, Crystal Growth and Microgravity (Daniel Henry, Hamda Benhadid)
- Chemical Diffusion Coefficients Measurements in Metallic Liquids (Peter - Lehmann, René Moreau)
- Elasticity and Growing (Alain Pocheau)
- Influence of external fields on segregation and structuration in solidification (Thierry Dufar)
- Numerical Modeling (Patrick Bontoux, Pierre Haldenwang, M. El Ganaoui)
- Thermal, thermo-solutal and thermo-vibrational Convection in microgravity (Abdelkader Mojtabi)
- High Performance Computing in Mechanics/ Vibrational Convection (Bernard

Roux)
We will here summarize some results obtained by these teams.