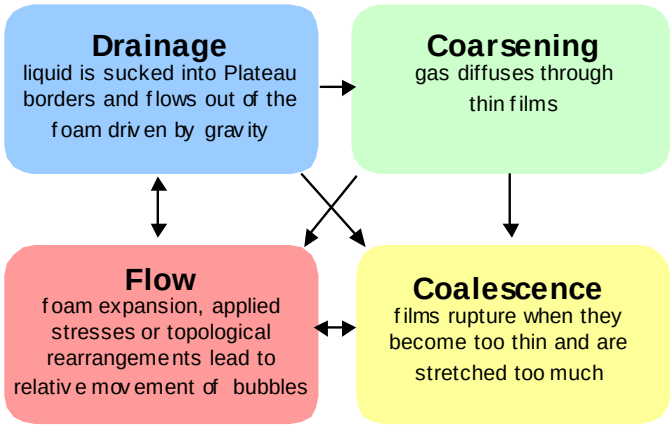
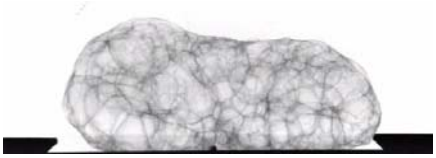
Development of Advanced Foams under Microgravity

The European Space Agency ESA has been funding a project with 5 partners from 4 European countries since the year 2000. The aim of the work in the project is to **investigate the foaming process** of wet aqueous and metallic foams **without** any disturbing **gravity**. As under normal terrestrial conditions many concurring processes take place at the same time in an evolving foam, the situation is quite confusing (see diagramme).



Eliminating gravitationally driven drainage would allow us to simplify this scenario. In particular we could study the coalescence behaviour of metallic foams in the absence of drainage, coarsening and flow and develop more stable metallic foams this way.

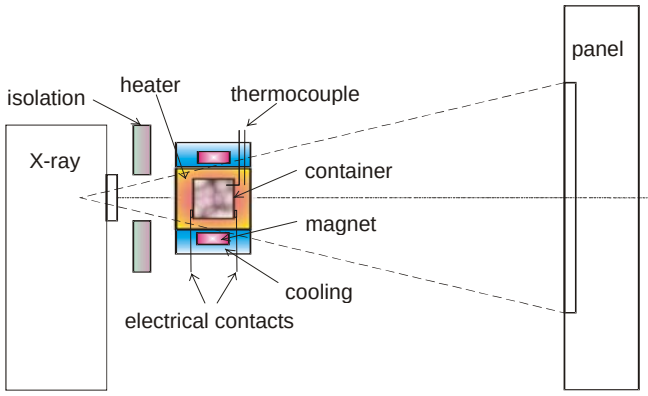
This is the idea of an experiment for the International Space Station ISS. It is planned to build a module which allows us to **produce aluminium foams**, to observe the development of their foam structure **in-situ** by **X-ray radioscopy**, and to **manipulate** these **foams** by applying external forces. We will be able to vary the composition of the material to be foamed, the foaming temperature and the heating rate.



X-ray image of an expanding aluminium foam

A possible layout for this experiment is shown schematically. The X-ray point source produces a projection image on the flat panel X-ray detector. Magnification is about 3 times, spatial resolution about 30 μm. Up to 2 images per second can be recorded. The foaming furnace allows us to produce small quantities of aluminium foam under precisely defined conditions. The magnets produce Lorentz forces in the foam whenever an electric current is passed through the foam. In this way movements in the foam can be stimulated to study rupture and relaxation processes.

The experimental module could also be used for other purposes such as for the study of solidification processes in low-melting metals.



Possible layout of a metal foam module on board of the ISS