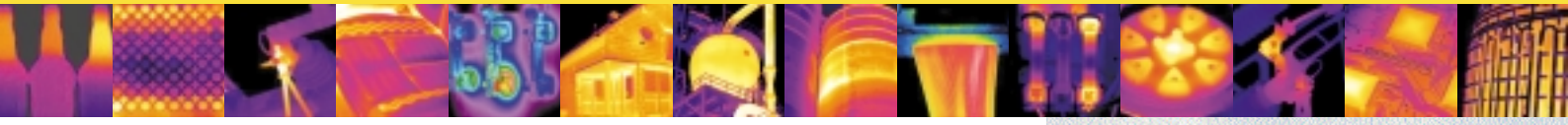

FLIR infrared camera on voyage of discovery to create pure crystals

The Soyuz rocket, with the FLIR Systems camera on board, a few hours before launch ready for its lift-off from one of the launching platforms of the "Plesetsk Cosmodrome" in Kazakhstan

A thermographic camera from FLIR Systems was a key component in experiments to create pure crystals in space. Although the process of crystallisation under zero gravity conditions did not result in the level of crystal purity scientists had hoped for, the FLIR camera system demonstrated why many similar experiments in space were unsuccessful, ultimately saving the considerable costs of pursuing this particular line of research.

Underlying this scientific investigation is the demand for very pure crystals for industries such as pharmaceuticals and electronic. Because terrestrial gravity produces irregularities in the formation of crystals, the scientific community had thought that higher purity levels might be achieved in a zero gravity environment.

The FLIR infrared camera was a component of FluidPac (Fluid Physics Facility), an instrument package specifically designed to conduct physical experiments and observe the behaviour of fluids in space. FluidPac was part of the total scientific instrument payload. In space for the first time, the objectives set for FluidPac were primarily focussed on observing and measuring specific thermo-capillary phenomena along free liquid-gas interfaces. It was these phenomena that were recorded by the FLIR infrared camera.
"Knowledge of convections inside liquids and the temperature diffusion at their surfaces are of great importance to gaining an insight into crystallisation processes," explains Antonio Verga. Verga, who is responsible for the European Space Agency (ESA) scientific instrument payload, is a member of the ESA Directorate of Manned Space Flight and Micro-gravity at the European Space Technical Centre (ESTEC) in Noordwijk, The Netherlands.

"For a long time it had been thought that it would be possible to create very pure crystals under zero gravity conditions. As the range of experiments conducted using FluidPac showed, this was a false anticipation. Our scientists discovered that even without the influence of gravity, irregularities in crystal formation still occurred. Importantly, the experiments did provide us with an explanation as to why this is the case."

A revolution in research
With the FLIR infrared camera it was possible to observe discontinuity in the temperature gradient at the surface of liquids. Moreover, the camera gave an exact picture of the isothermal rings within liquid, showing that they were convecting in concentric circles.

Foton-12 being installed in the fairing system of the Soyuz rocket. Through observations made with the aid of the FLIR Systems' camera, scientists discovered a phenomenon in the behaviour of fluids in weightlessness conditions that adversely influences crystal growth.

Says Verga: "This transition to chaos had never been observed before. Even the interferometers onboard did not register the effect; it was only the infrared camera that was able to record this phenomenon. It is a rare occasion that you are offered such a clear image of a phenomenon that causes a revolution in research and my fellow scientists could not stop looking at the unique images that were transmitted back to Earth."

Convection in liquids in conditions of weightlessness is caused by surface tension. This is the force that makes a liquid a liquid: the tension at the surface resists evaporation; it maintains the integrity of the fluid (a soap bubble is an observable example of surface tension). The effects of the Earth's gravity make it impossible to measure surface tension.
Because of its valuable contribution to the research being undertaken, it has been decided that the FLIR camera system will be an integral part of FluidPac in the next mission in the ESA programme.