

## II.6. PHYSICAL-CHEMICAL PROCESSES UNDER MICROGRAVITY

---

### PHYSICAL-CHEMICAL PROCESSES UNDER MICROGRAVITY («Morphos» Project)

Nemoshkalenko V. V.

*G. V. Kurdyumov Institute of Metal Physics of the NAS of Ukraine  
36 Akademik Vernadsky Blvd., Kyiv-142, 03680 Ukraine  
tel: (380) +44 +4441005, fax: (380) +44 +4442561,  
e-mail: metall@imp.kiev.ua*

**Introduction.** The Ukrainian Program for study of the physical-chemical processes under microgravity proposed for the ISS, concerns the basic problems of physics of liquid and materials science.

The Program contains six experiments, where authors propose not only the newest advanced theoretical conceptions but also the original technological ideas. Despite the fact that now these experiments are at different levels of flight maturity of the experimental installations they will provide new knowledge after their implementation onboard the ISS.

The proposed experiments can be conditionally divided into three groups depending on the subject and on the role, which the microgravity factor plays in the processes to be studied.

«HERUBIM» experiment to study the microgravity influence on parameters of heat exchange and dynamics of the vapour phase in boiling of liquid helium is included in the first group of experiments, namely the physics of liquids under microgravity conditions. The authors intend also to correct the methodological errors of space experiments carried out earlier in this field.

The next experiments belonging to the second group, namely the materials science under micro-

gravity, can result in new technological solutions in space production of materials.

The proposed «Morphos» experiment concerns the process of directional crystallization under microgravity with three-dimensional preparation. It allows overcoming a number of difficulties appearing in interpretation of results for quasi-two-dimensional preparations.

The conception of an on-board installation to study the processes of manufacturing the composite materials from immiscible components (Zn-Pb, Al-Pb, Ag-Fe, Al-W) is proposed in the «Sound» experiment. Such materials have unique physical and mechanical properties. The authors use the method of ultrasonic excitation for compensating the deleterious effects introduced by Marangoni convection and other processes.

The next experiment in this group is to study the processes of manufacturing the eutectic alloys of Ni-Nb-C system by the method of electron beam zone melting. An original concept of the unit for carrying out this research is proposed.

The processes of soldering composite ceramics and glasses with molten metal solders are studied in «Brazing» experiment.