



**BULGARIAN ACADEMY OF SCIENCES**  
**SPACE RESEARCH AND TECHNOLOGIES INSTITUTE**  
**Laboratory “Vacuum Investigations”**

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## History and Main Activities of the Laboratory

- **Created in 1987**
- **Research Area**
  - Processes, materials and devices, related to space applications
  - Vacuum Tribology and Materials Science
  - Development of new composite materials with improved anti-frictional properties
- **Collaborations**
  - ✓ Institute of Materials Science,  
National Academy of Sciences of Ukraine
  - ✓ Austrian Research Centre Seibersdorf,  
Aerospace Materials Department



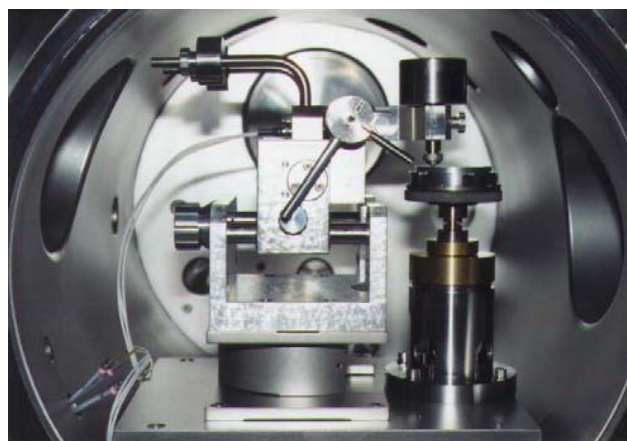
## New Composite Materials with improved anti-frictional properties of the type “IPM”

### Functionality

- **new class** of highly effective composite anti-frictional materials
- work flawlessly
  - without lubrication
  - in the absence of oxygen, moisture and in vacuum
  - Without formation of centers of tear, gearing and cold welding at the tribocontact

### Tribological Characteristics

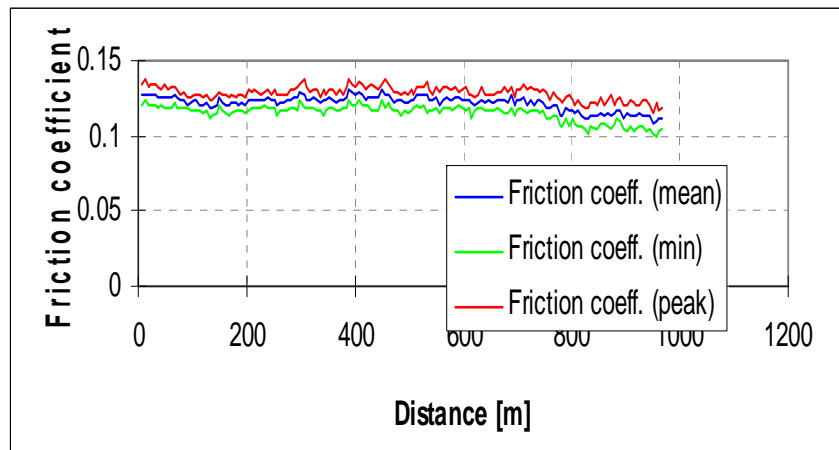
- Small stable coefficient of friction during long exploitation
- High wear sustainability at increased loading at the point of contact
- Adaptivity of the frictional surface to the regime of friction



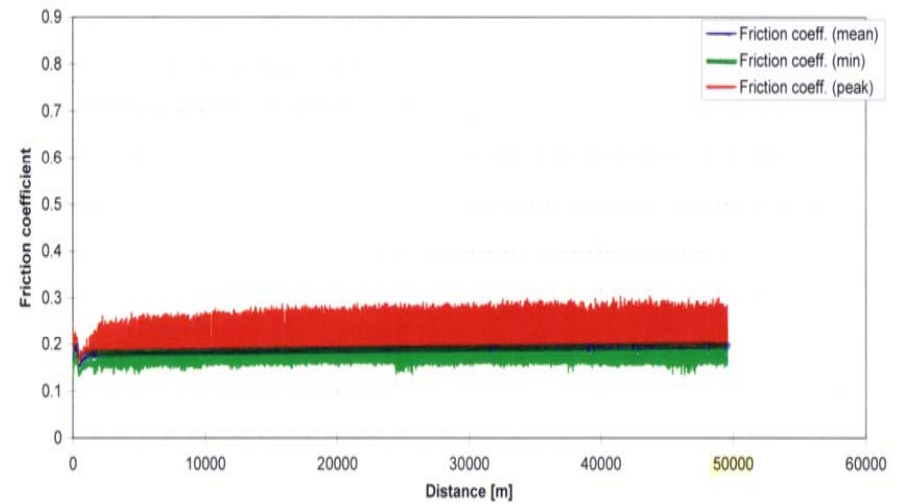
Изследване с UHV- трибометрична апаратура



## Material IPM-304



Variation of the coefficient of friction during 1000 meters for a gearing in dry friction and in vacuum with speed 1.0 m/s and load 2 N (IPM-304)

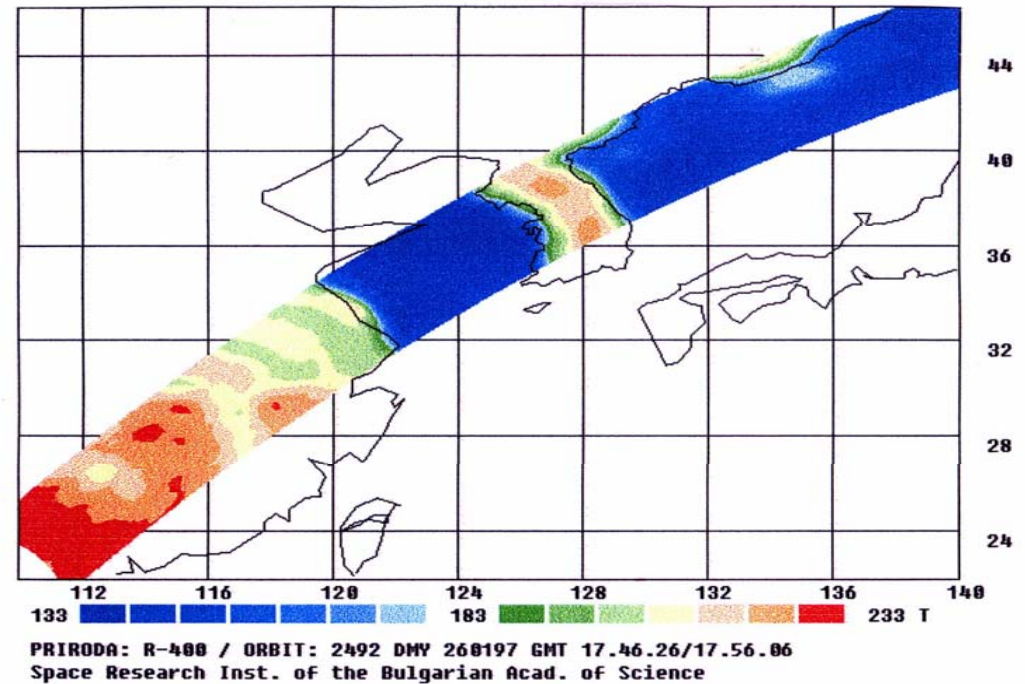
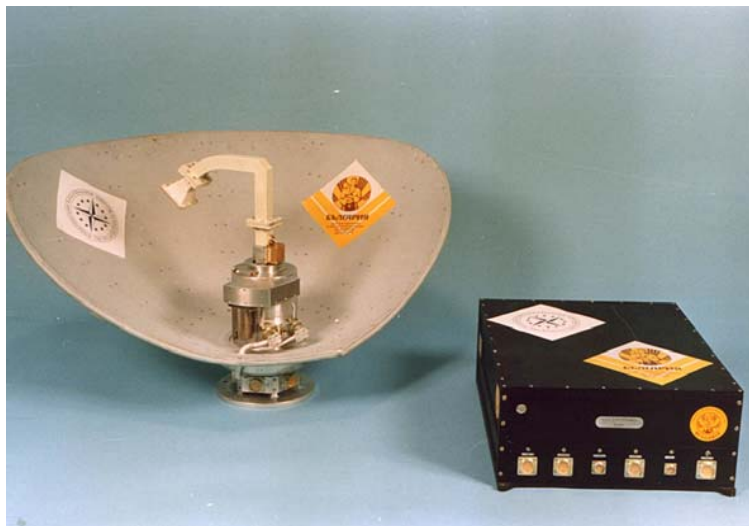


Variation of the coefficient of friction during 50 000 meters for a gearing in dry friction and in vacuum with speed 0.2 m/s and load 20 N (IPM-304)



## Material IPM-301

Material **IPM-301** is used in the gears of the starting module of the system “**P-400**”, installed on the Orbital station “**MIR**” (1996 – 2001)



View of part of the Earth surface in the trajectory of the station “MIR” in the region of **Indo-China – Korean Peninsula**, obtained by the radio-metric system “**P - 400**” in space