VITREOUS CARBON TECHNOLOGY

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Spherical probes for measurements of electric fields aboard satellites

Use of a double probe -

measuring DC and AC electric fields in space plasma aboard satellites, rockets, and space stations

1980: Original method of glass-carbon coating on surfaces of graphite and ceramic materials

- **for exploitation of the probes for measurements of electric fields in the ionosphere-magnetosphere plasma on board of satellite "IK-Bulgaria 1300"**
- **created by a group at SRTI and Institute of Metal Science - BAS**

The method is protected by a patent in Bulgaria.

Satellite IK-Bulgaria 1300, launched 1981

Technological process for obtaining Vitreous Carbon Layers

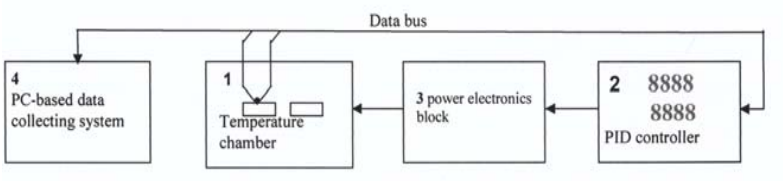
❑ Production of carbon-hydrogen substance (CHS)

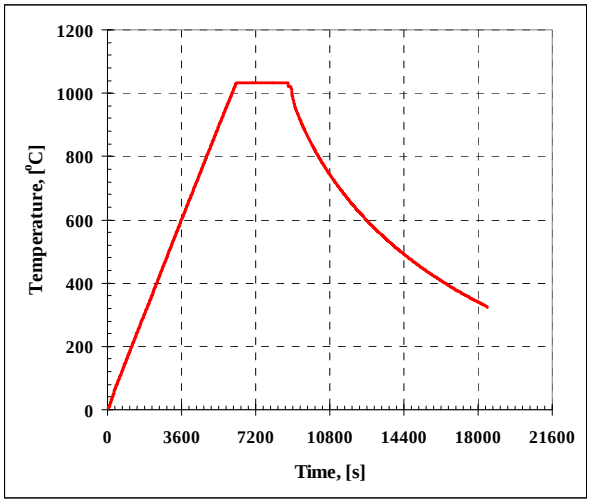
- ➢ Obtaining of Starting material for probe surface coating:
  - ✓ Polyvinyl chloride (PVC) powder was decomposed in an atmosphere of pure Ar or N_2 by holding for 30 min at temperatures 390-400°C. A black shining substance was obtained; analysis showed only the presence of C and H and it could be represented by the generalised formula $C_8H_{7.}$
- ➢ Coating procedure:
  - ✓ Thus, the obtained material is thermally treated in vacuum or argon atmosphere at temperature 1000 °C with rate of heating 15-20 °C /min and duration 5-10 minutes. After cooling, the process of the precipitation of the polymer materials is repeated several times until obtaining of surfaces with max thickness 20 μm.

Laboratory Equipment for Vitreous Carbon Technology

Four vacuum high-temperature furnaces with temperature regime control with accuracy of 1°C and data collection:

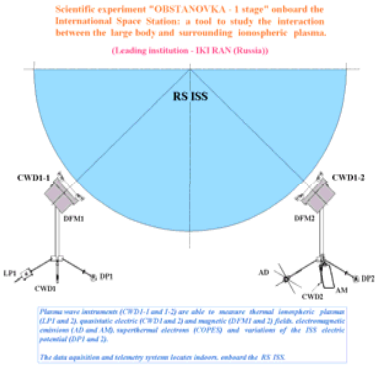
- Up to 1000 °C; Up to 1300 °C; Up to 1500 °C; Up to 2000 °C



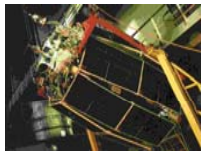


VITREOUS CARBON TECHNOLOGY ABOARD SATELLITE EXPERIMENTS

"IC Bulgaria 1300" 1981

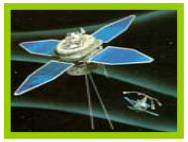


- Project "Potential"- body charge of space vehicles, Russia;
- Experiment "Obstanovka" on-board the International Space Station ("ISS , 2012)

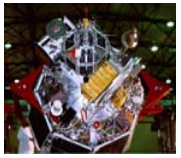


"IC 24", 1989

"IC 25", 1992



"Interball-2", 1996

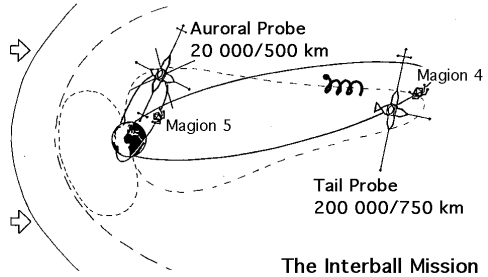


"Magion 2", 1989

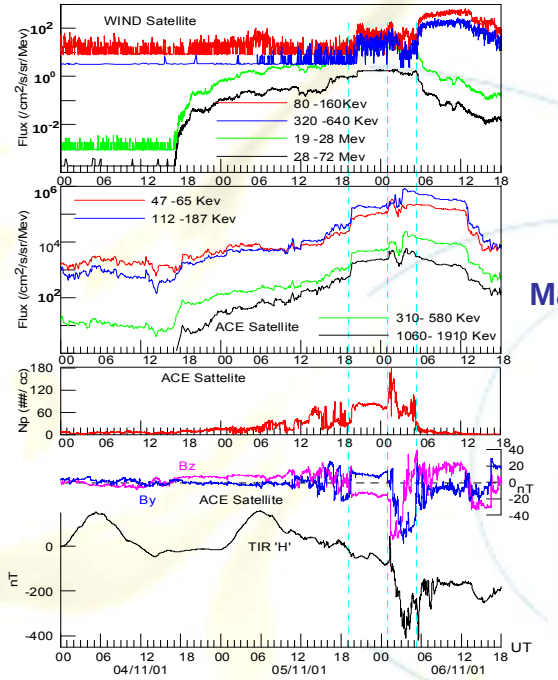
"Magion 3", 1992

"Magion4", 1995

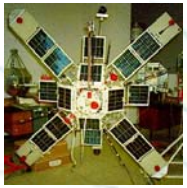
"Magion 5", 1996



Use of the results from Electric Field measurement to Space Physics and Space Weather problems

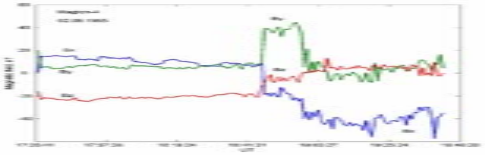


The resuts of this project are presents at international scientific meetings and conferenses and published in scientific journals: *35th COSPAR, Paris, France 2004; 36th COSPAR, Beijing, China, 2006; ISROSSES, Varna Bulgaria 2007; PLASMA - 2006, Jaipur, India 2006; WDS 2007, Praha , Czech Republic,2007; Journals ASR, JASTP end ad.*

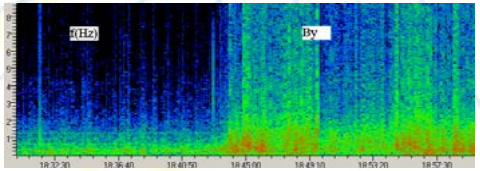


Magion-4 Satellite

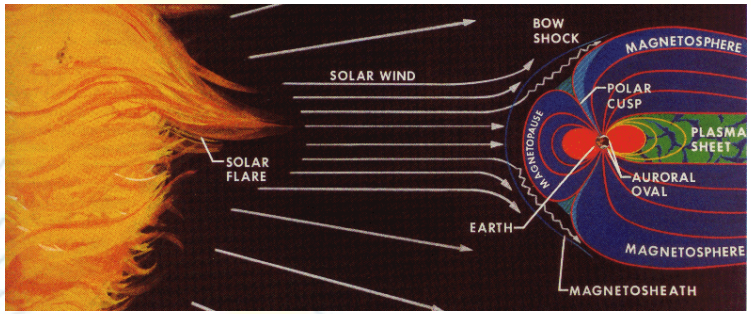
Magion-5 Satellite



Magnetic field measurements in the magnetosphere.



ULF waves in the magnetopause region



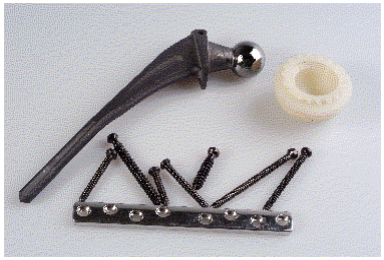
The following results are expected:

- To clear up the basic physical relations between generation of FAC and ELF/ULF waves in the magnetosphere.
- To have more adequate knowledge on the microstructure of wave processes in the boundary region of the magnetosphere (magnetosheath, magnetopause, cusp) on the base of multi component wave measurements.
- To receive a better estimation of the transfer of MHD energy from the magnetosphere towards the atmosphere of the Earth.

VITREOUS CARBON TECHNOLOGY in other AREAS

Medical Implementation :

-Composite ceramic materials based on vitreous carbon as transplanting materials in the human organism.

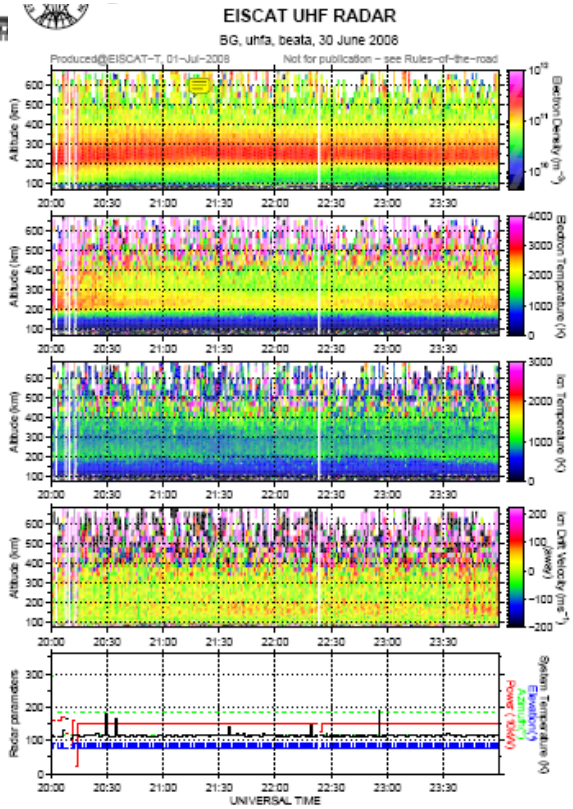


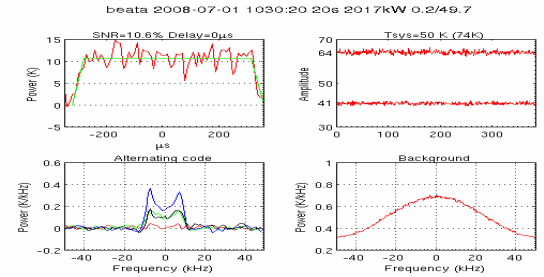
Implementation in Industry (mechanical, chemical and other) :

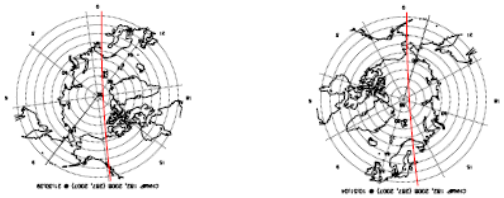
-Supports, crucibles, fiberguide, elements and the details used at receptions the pure substances.

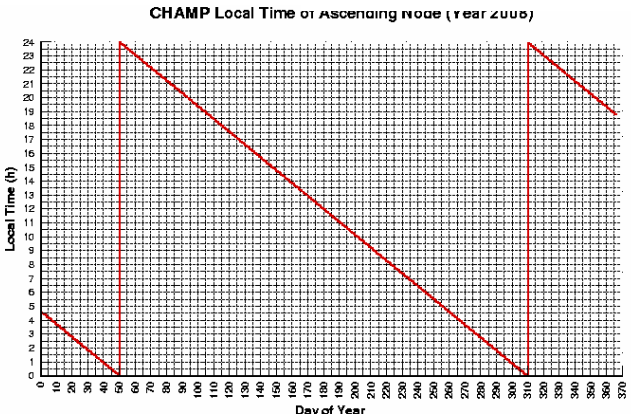
Implementation in Powder Metallurgy :

-Carbon hydrogen containing substance as donor of carbon for Powder Metallurgy (PM)

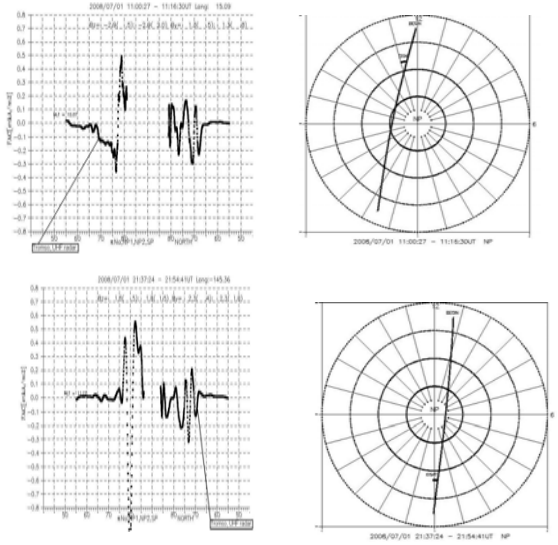


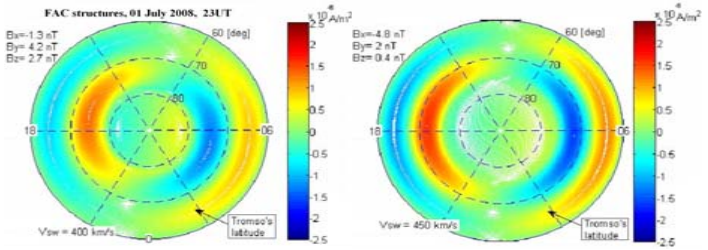






EC EISCAT TNA Program (2008 – 2011) "Magnetosphere/Ionosphere Coupling: Large Scale and Small Scale FAC Structure Interactions and Energy Transfer in the System" PI - Dr. D. Teodosiev





D. Teodosiev, et all, (2011), *Comptes rendus de l'Académie Bulgarie des Sciences* , vol. 64, № 5, pp. 729-736, 2011