

A detailed illustration of a spacecraft in space. The spacecraft is in the foreground, showing a large circular hatch with several glowing yellow lights inside. The background features the Earth and the Moon, with a starry space field. The title text is overlaid on a semi-transparent dark band across the top.

Role of low-energy electrons in developing novel materials for highly demanding space missions and applications

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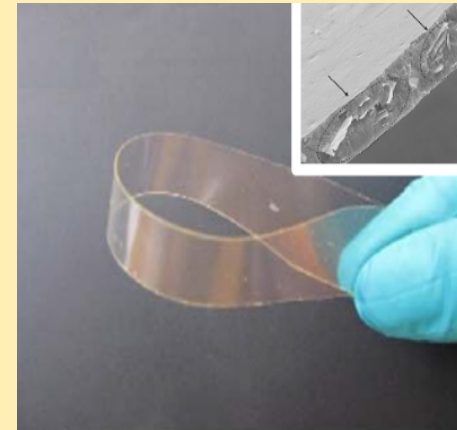
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(Stefano Iacòbucci – CNR-ISM)



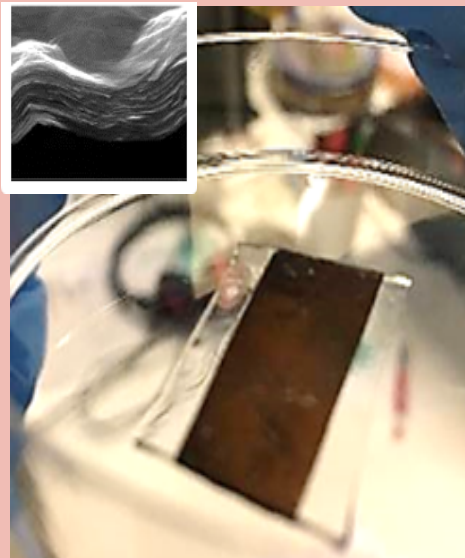
FABRICS

Electrospun mats of
polymer microfibers



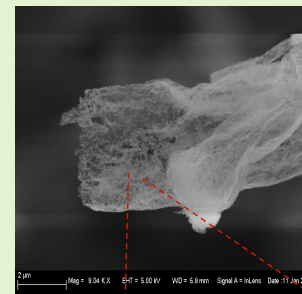
BULK COMPOSITES

1D/2D nanofillers
in polymer matrix



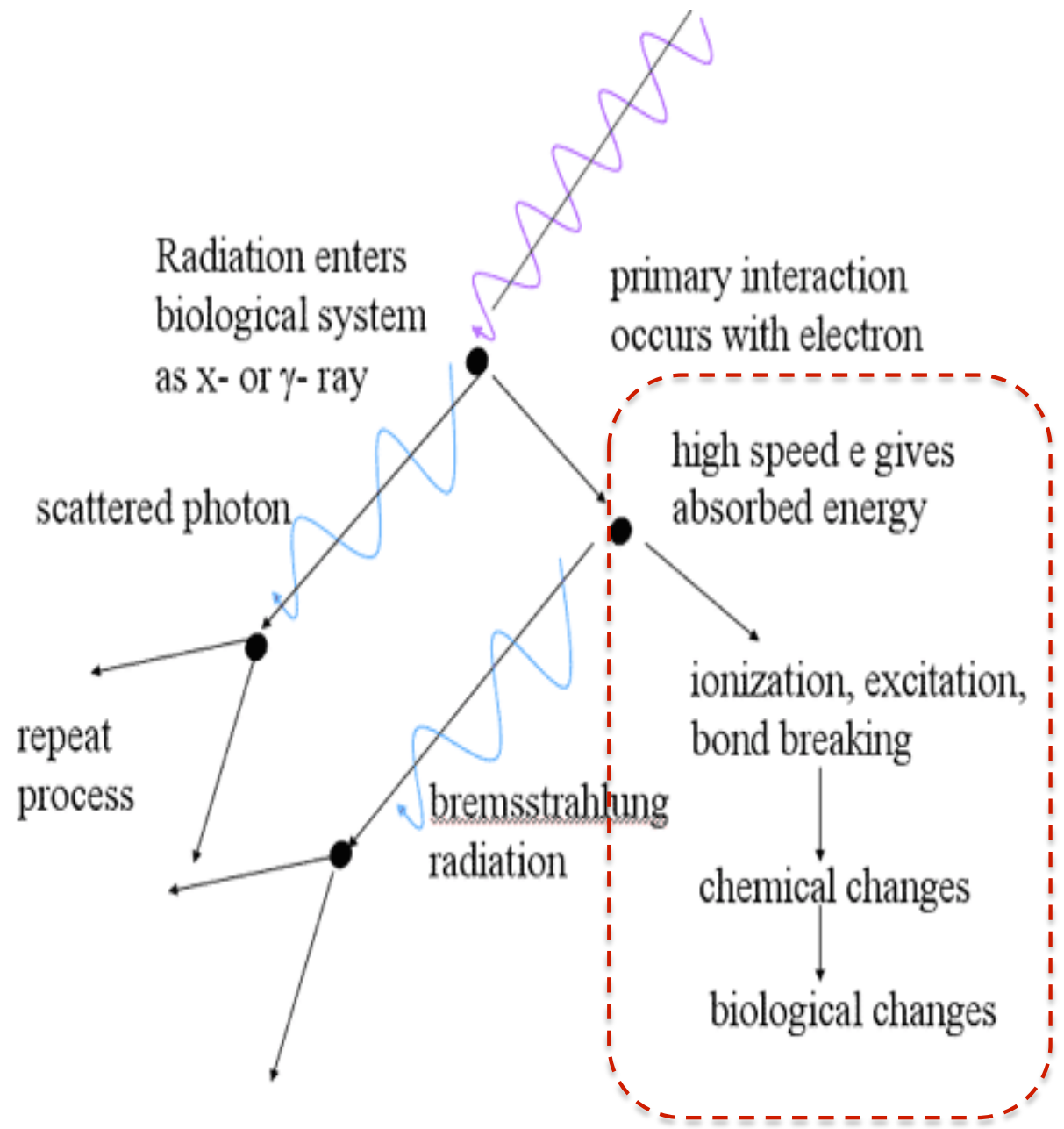
MEMBRANES / COATINGS

Networks of partially
stacked 2D nanosheets



SPONGES

3D Networks
of 2D nanosheets

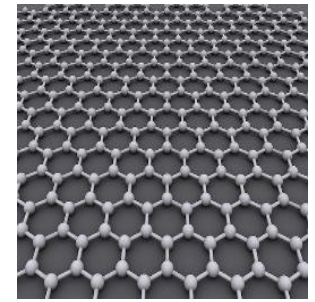


Low-energy electrons

Used materials



Polymers

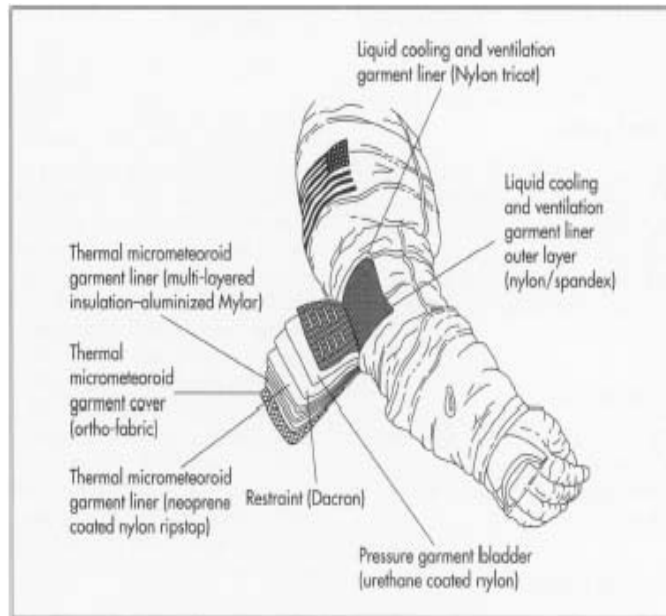


Graphene-based materials (GRM) & related 2D

- Low Z materials:
- ✓ lightweight,
 - ✓ hydrogen-rich
 - ✓ less secondary radiations

MATERIALS FOR SPACESUIT

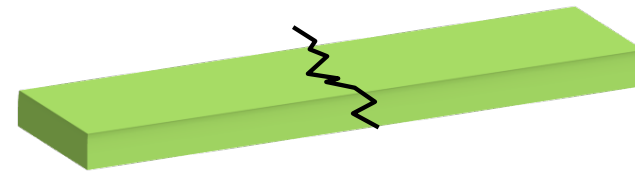
Multifunctional composite fabrics for radiation shielding



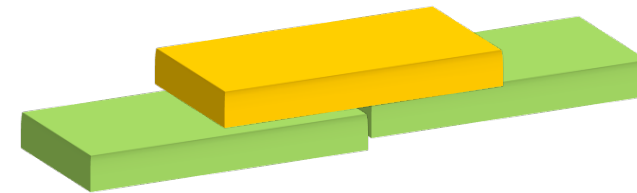
- ✓ Matrices: PET / PA6 (nylon)
- ✓ Fillers: graphene-like (GRM) / BN nano/micro-flakes

«IN-ORBIT» REPAIR OF STRUCTURAL DAMAGE

1. breaking



2. repair



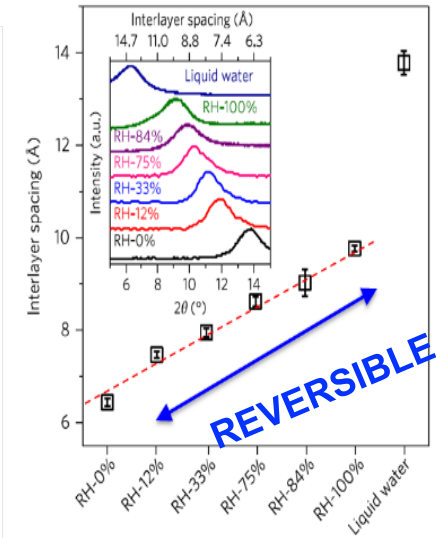
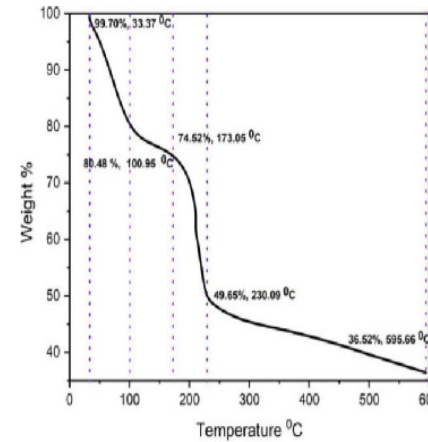
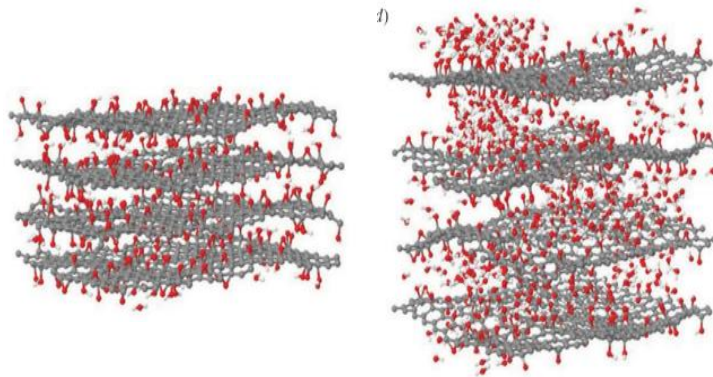
- ✓ Adhesives
- ✓ Carbon-based prepregs (epoxy-carbon fibers)



GRAPHENE OXIDE (GO) MEMBRANE

water content (up to 30% in mass)

GO lamelles trap water



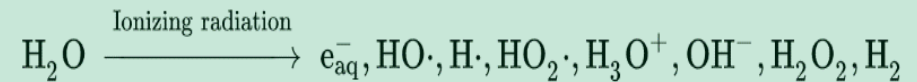
Water

PROS

CONS

- ✓ hydrogen-rich
- ✓ electron stopper

- ✓ radiolysis

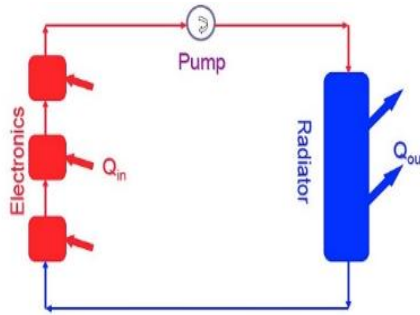


Partial GO reduction

GO (high conc) → RGO

Loop heat pipe (LHP)

evaporation

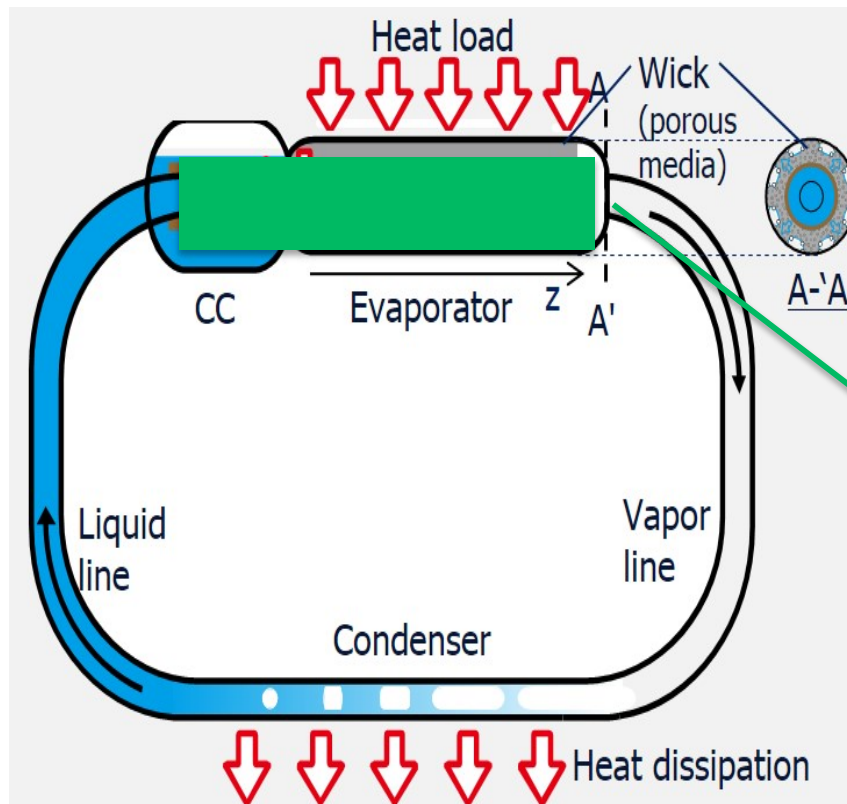


condensation

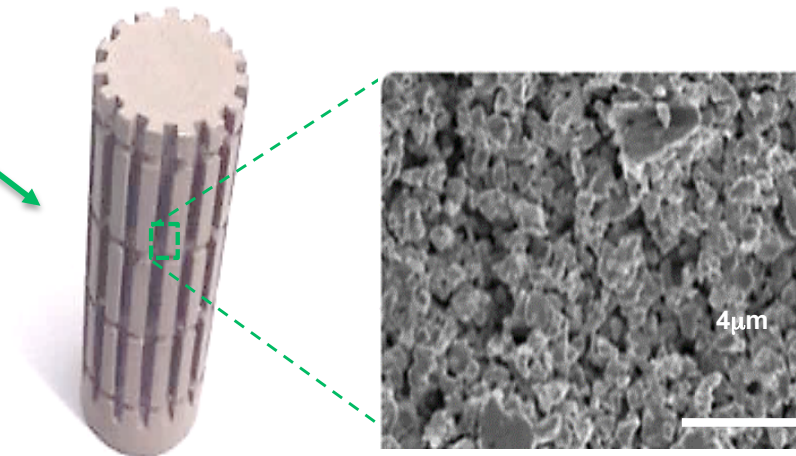
GO coating

- ✓ permeability improvement
- ✓ better performances
- ✓ aging effects in-orbit

GO reduction due to radiolysis?



wick



Micro-porous structure



Consiglio Nazionale delle Ricerche



ALL WE NEED IS ~~LOVE~~

TO DEEPLY UNDERSTAND THE ELECTRON-MATTER INTERACTIONS

COLLABORATION

THEORY

SIMULATIONS

EXPERIMENTS

FUNDINGS

FAME

...

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