



Molecular Adsorber Coatings

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About the Speaker



Image Credit: NASA/GSFC/PAT IZZO

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What we will discuss...

01

- Off-gassing vs. Outgassing
- Molecular Contaminants

02

- Coatings Technology Description

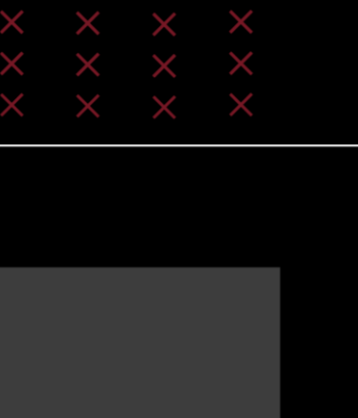
03

- NASA Ground and Flight Applications

04

- Potential Commercial Applications

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Off-gassing



- On Earth, off-gassing is a part of everyday life!
- Most manufactured materials and consumer products release gaseous chemicals that are potentially harmful to human health

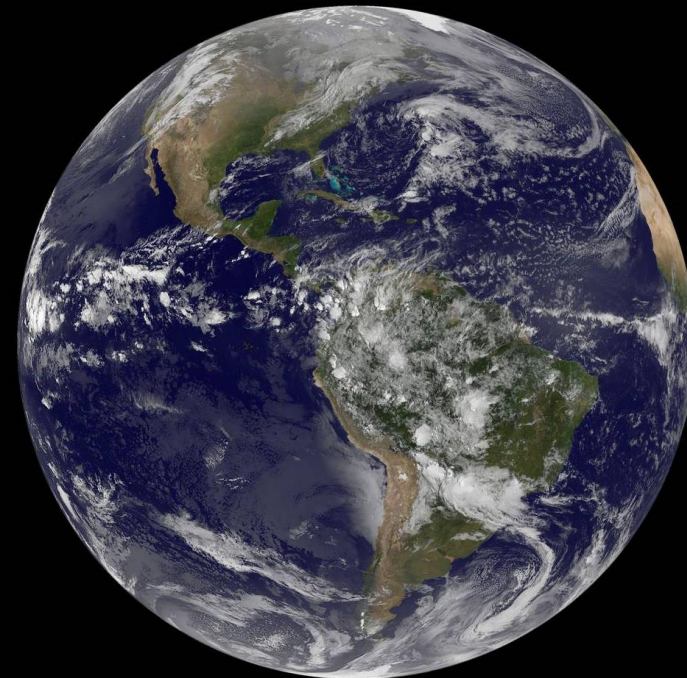


Image Credit: NASA/NOAA/GOES

Outgassing

- Outgassing occurs in spaceflight applications during orbit in space or testing in vacuum chambers
- It poses a significant threat to NASA missions
- Originates from materials that release molecules inside of the spacecraft
- Results in molecular contamination concerns



Image Credit: NASA

Molecular Contaminants

- Can deposit on sensitive surfaces that are critical to the success of NASA satellites and instruments
- Can degrade mission performance and lifetime



Image Credit: NASA/JWST

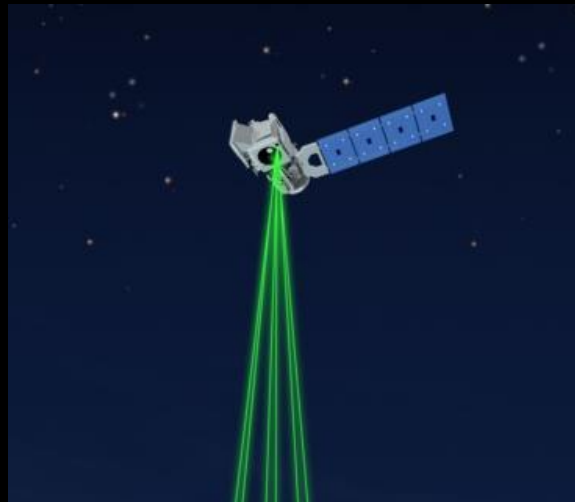


Image Credit: NASA/ICESAT2

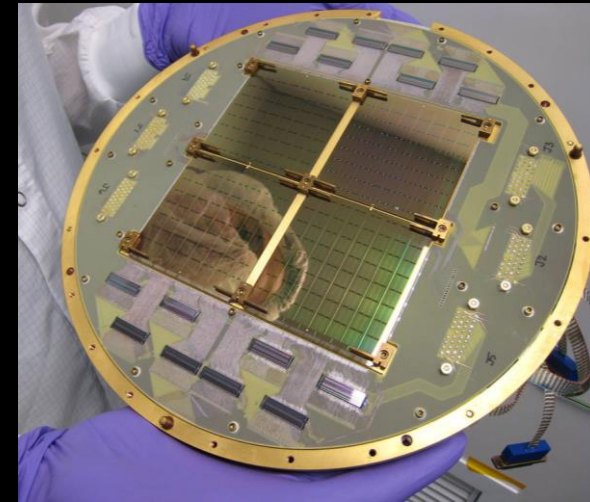


Image Credit: NASA/JPL

MAC Technology

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- Molecular Adsorber Coatings (MAC)
- Sprayable coatings technology
- Available in white (MAC-W) and black (MAC-B) coating variations

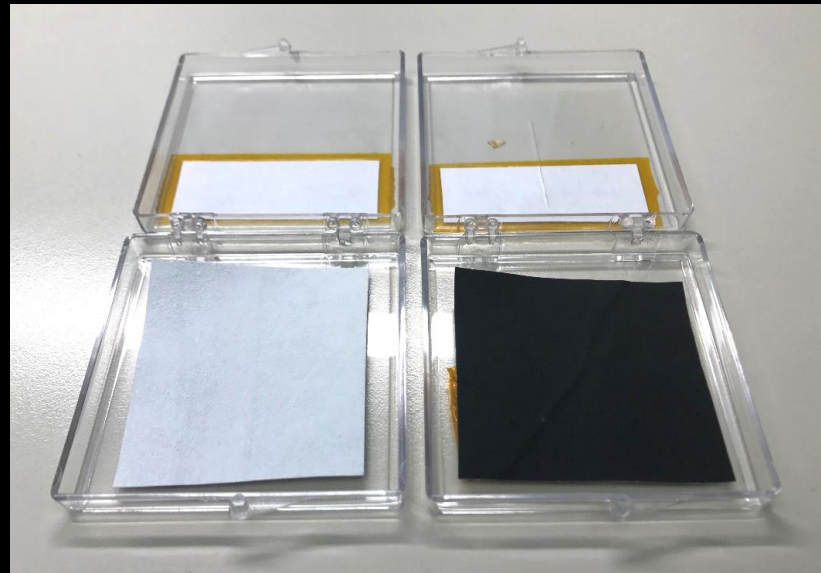


Image Credit: NASA/GSFC

MAC Technology

- Developed by NASA Goddard Space Flight Center
- Mitigates outgassing concerns on or near sensitive surfaces for NASA missions
- Reduces risks associated with molecular contamination

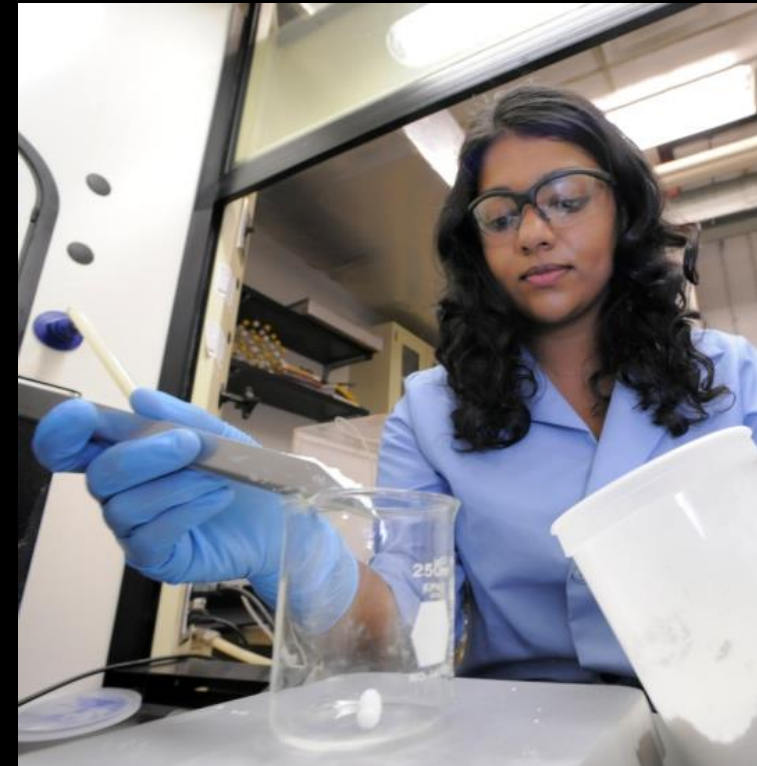
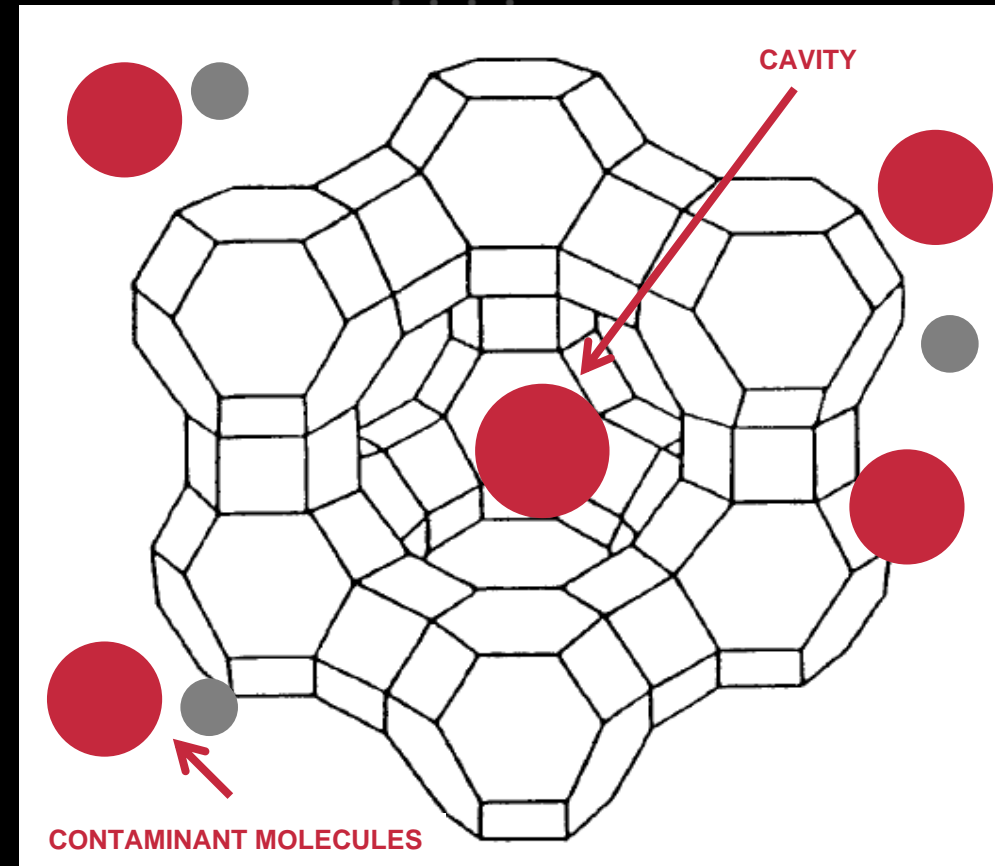


Image Credit: NASA/GSFC/PAT IZZO

MAC Technology

- Designed with porous zeolite materials
- Passively captures outgassed molecular contaminants within cavity structure



MAC Technology

- Has high surface area and roughness for improved adsorption properties
- Adsorbs common spaceflight outgassing threats, including hydrocarbons, silicones, and plasticizers

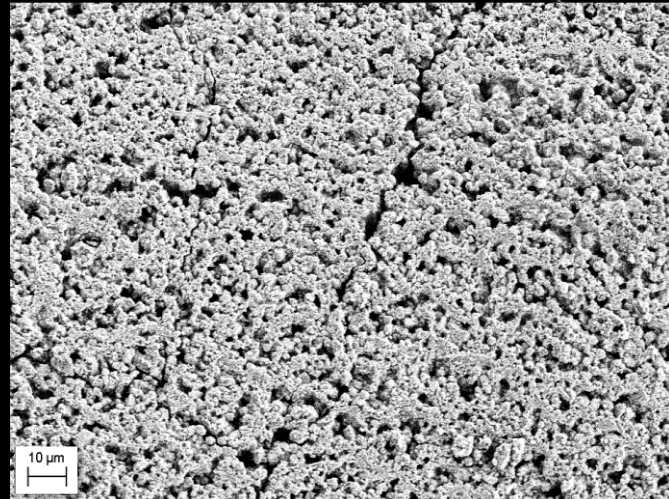


Image Credit: NASA/GSFC

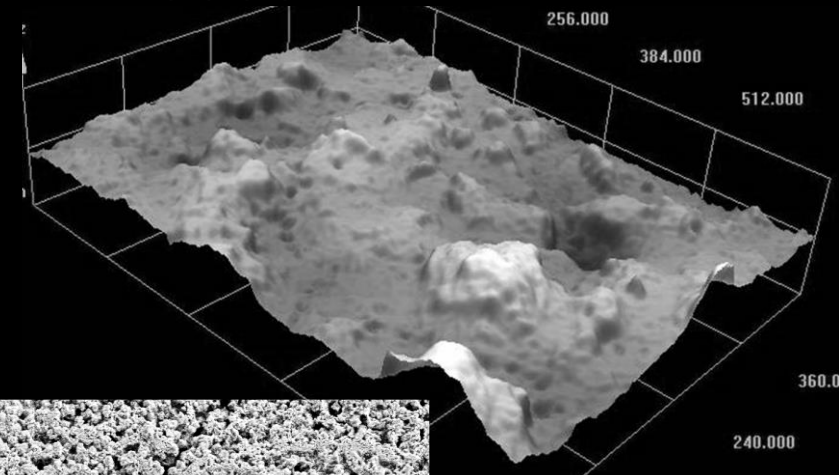


Image Credit: NASA/GSFC

NASA Ground Applications

- Used in vacuum chambers as a “getter material” during testing of critical hardware and components
- Mitigates risks of molecular contaminants from chamber environments

Image Credit: NASA/JWST



Image Credit: NASA/JWST

NASA Ground Applications

- **NASA Mission:** James Webb Space Telescope (JWST)
- **MAC Application:** Used during cryogenic thermal vacuum testing of critical flight telescope and optical ground support hardware
- **Location:** Chamber A at NASA Johnson Space Center from 2014-2017



Image Credit: NASA/JWST/CHRIS GUNN

NASA Flight Applications

- Used in space on satellites and spacecraft within internal instrument, optical, or laser cavities
- Reduces effects of on-orbit material outgassing concerns



Image Credit: NASA/ICON/UC BERKELEY

NASA Flight Applications

- **NASA Mission:** Ionospheric Connection Explorer (ICON)
- **MAC Application:** Installed in contamination sensitive far ultraviolet instrument cavity benches of imager and spectrograph
- **Location:** Low Earth Orbit (LEO) altitude at ~ 575 km; launched October 10, 2019

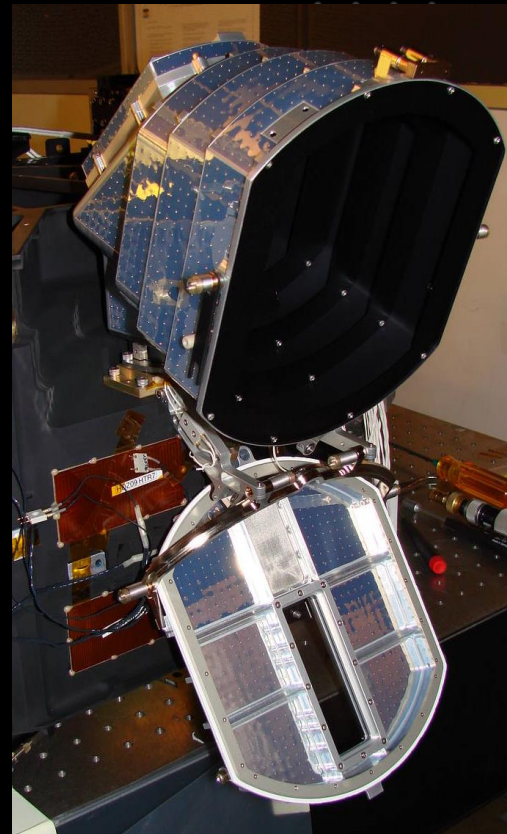


Image Credit: NASA/ICON/UC BERKELEY



Image Credit: NASA/GSFC



Commercial Applications

- Potential commercial applications may include industries that require general gas adsorption, or collection and containment of outgassed/off-gassed contaminants and volatiles

AEROSPACE

VACUUM SYSTEMS

CONSERVATION & PRESERVATION

SEMICONDUCTOR

OPTICS

PHARMACEUTICAL

LASERS

AUTOMOTIVE

ELECTRONICS

CHEMICAL PROCESSING

MANUFACTURING

MEDICINE

Museum Conservation

- Museums also face challenges of molecular contaminants that can promote degradation of historic specimens on display in exhibits or in cabinets at storage facilities

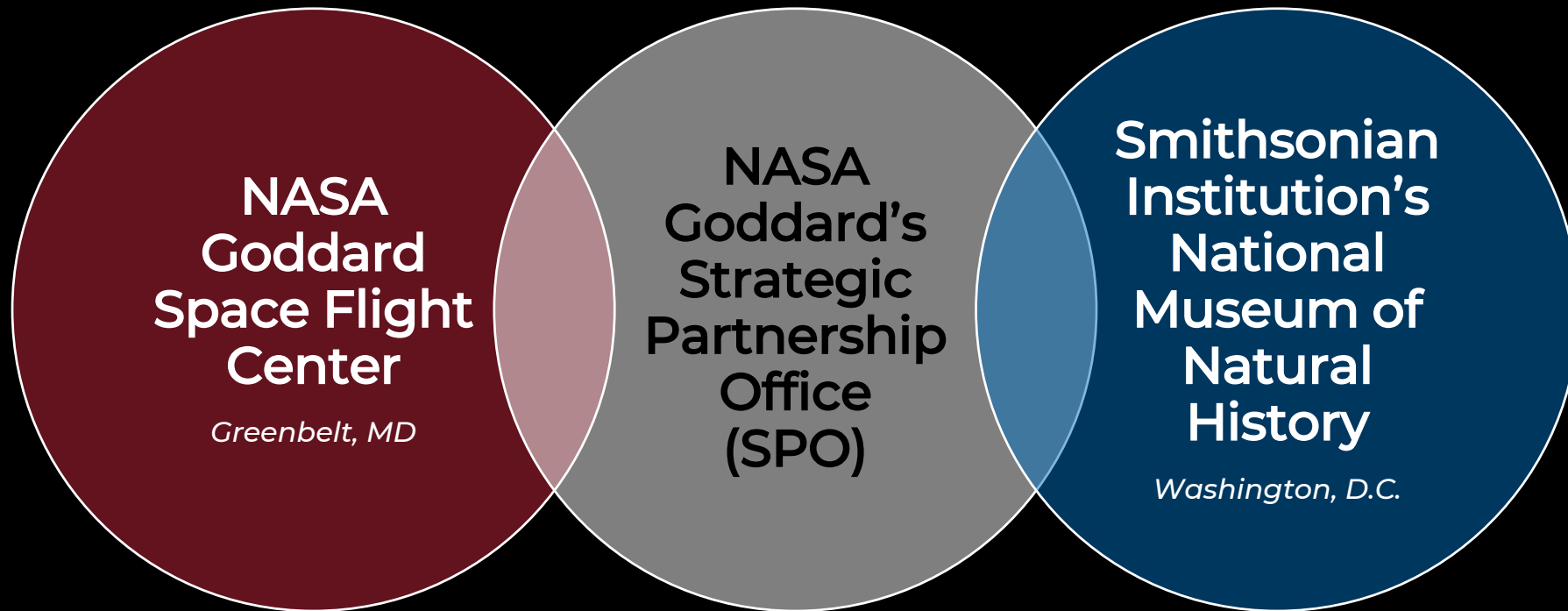


Image Credit: NASA



Museum Conservation

- Established NASA Space Act Agreement



Museum Conservation

- Investigating use of NASA's MAC technology to protect natural science collection items from contaminants, such as mercury vapor and organic/inorganic compounds that are present in storage cabinets



Image Credit: NASA/GSFC/CHRIS GUNN

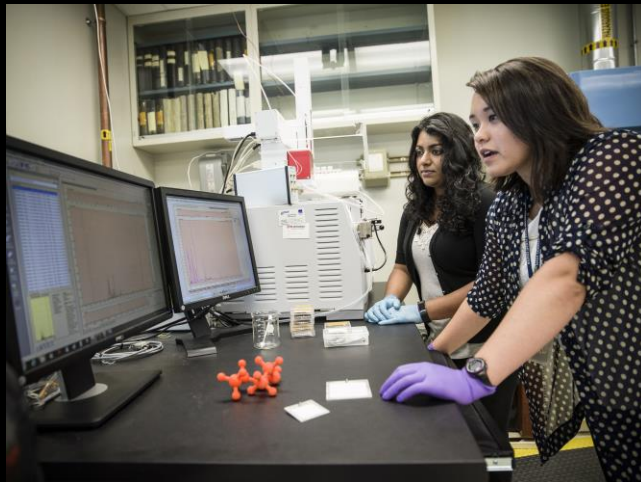


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