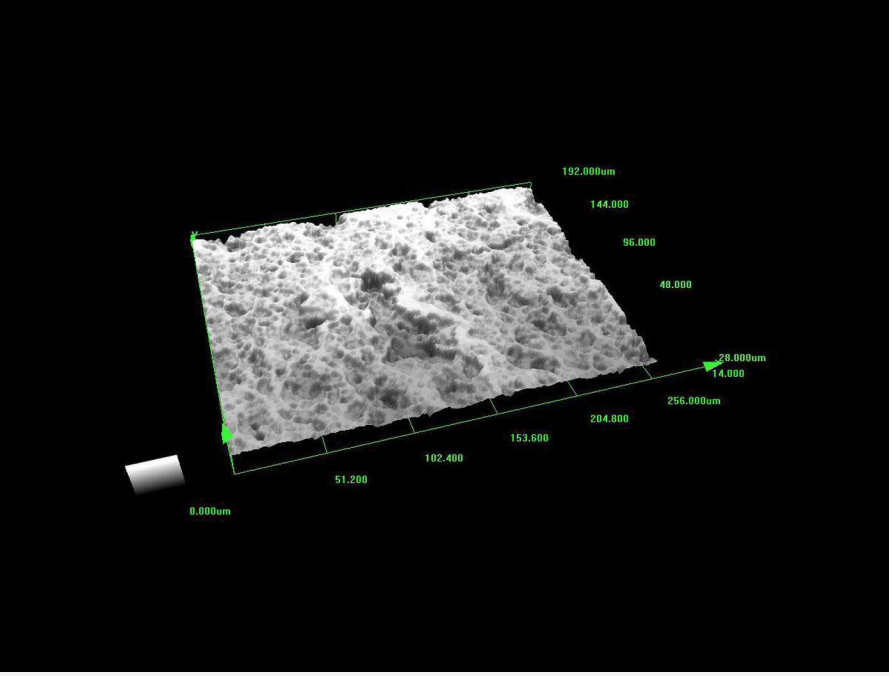

National Aeronautics and Space Administration

Materials and Coatings

Molecular Adsorber Coating (MAC)

Capturing outgassed volatiles using a simple spray coating

Many materials contain gasses that are trapped on or within the surface that, when in vacuum, will escape the host material over time - a process known as outgassing. The extent of outgassing is a function of the material, temperature, and the vacuum level present. To address outgassing issues in spacecraft, NASA has historically used zeolite based molecular adsorbers in spacecraft and instruments to collect and retain outgassed molecular effluent emanating from potting compounds, epoxies, tapes, lubricants, and other spacecraft materials, protecting critical contamination sensitive surfaces. Uncontrolled, molecular contamination can cause significant degradation of instrument performance, thermal control properties, solar array efficiency, optical surfaces, laser systems, detectors, cryogenic instruments, and high powered electronics. In an effort to simplify previously flown complex zeolite coated cordierite molecular adsorber puck systems, such as those flown on Hubble Space Telescope (HST), Goddard Space Flight Center has developed a portfolio of molecular adsorber coatings (MAC).

BENEFITS

- Better adsorption than other coating slurries: NASA's MAC is far superior to other adsorber coatings previously tested or developed by NASA GSFC.
- Coat virtually any surface: NASA's MAC exhibits excellent adhesion to multiple substrates, including but not limited to composites, cellulose based materials, aluminum, and other metals.
- Easy to formulate & apply: Based upon commercially-available and low-cost chemicals, NASA's MAC can be deposited via simple water-based spray techniques to thicknesses in the 100-250 micron range (i.e., 4-10 mils), depending on application.

technology solution

THE TECHNOLOGY

MAC is a zeolite based coating that captures and traps molecules in its microscopically porous structure. This microscopic nano-textured structure, consisting of large open pores or cavities, within a crystal- like structure, provides a large surface area to mass ratio that maximizes available trapping efficiency. MAC is a durable coating that is applied through spray application.

These sprayable coatings eliminate the major drawbacks of puck type adsorbers (weight, size, and mounting hardware requirements), resulting in cost savings, mass savings, easier utilization, greater adsorber surface area, more flexibility, and higher efficiency.

This coating works in air, as well as vacuum systems, depending on the application. There are potential for ground based spin-off applications of this coating, particularly in areas where contaminants and volatiles need to be collected and contained. Example industries include: pharmaceutical production, the food industry, electronics manufacturing (circuit boards and wafers), laser manufacturing, vacuum systems, chemical processing, and general gas and water adsorption.

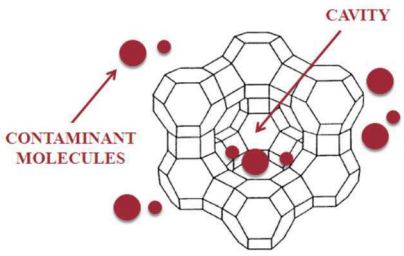

Figure 2.

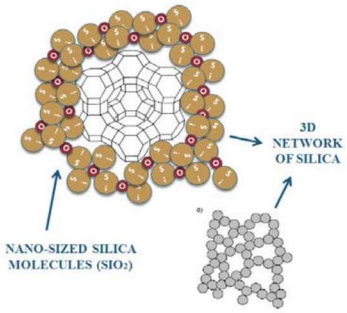

Figure 3.

Figure 2.: Large pores or cavities on the crystal structure of zeolite capture and trap contaminant molecules; Figure 3.: Nano-sized silica molecules of the binder gels around the pigment without blocking the adsorption sites

APPLICATIONS

The technology has several potential applications:

- General gas and water adsorption
- Collection and containment of contaminants and volatiles

PUBLICATIONS

Patent Pending

Abraham, N., Hasegawa, M., & Straka, S. (2012). Development and testing of molecular adsorber coatings. Optical System Contamination: Effects, Measurements, and Control 2012.

More Information

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