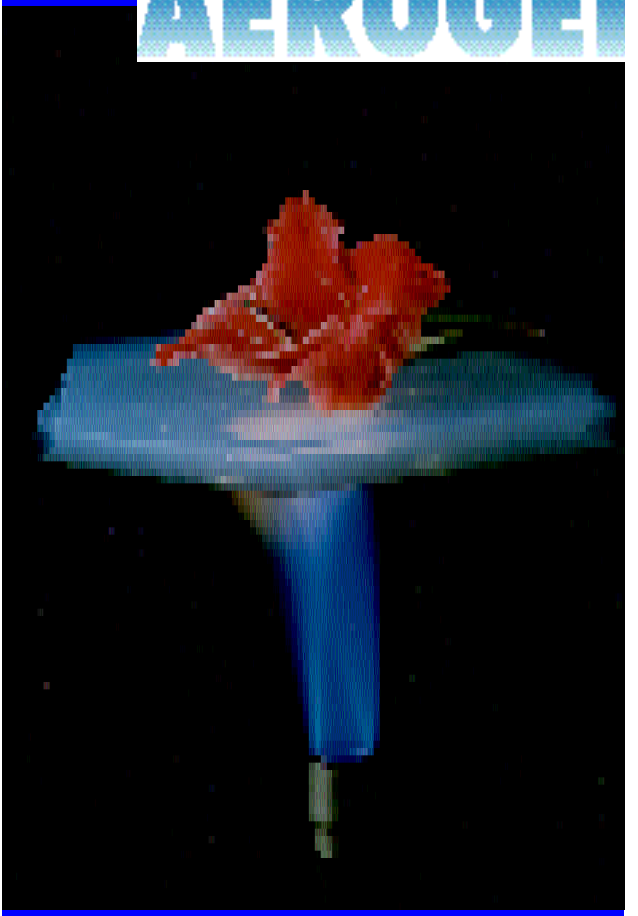
AEROGEL



Mystifying “Blue Smoke”

JET PROPULSION LABORATOR

At first sight, aerogel resembles a hologram. A highly insulative solid material, aerogel has the lowest density of any known solid. One form of this extraordinary substance is 99.9 percent air and 0.1 percent silica dioxide (by volume). One thousand times less dense than glass, aerogel has earned the nicknames “blue smoke” and “solid smoke.” It is an important material for our future.

A block of aerogel as large as a human may weigh less than half a kilogram (or less than a pound), yet support the weight of a subcompact car (about 454 kilograms, or 1,000 pounds). At the Jet Propulsion Laboratory (JPL), an enhanced form of aerogel has been developed for use in several space-related applications.

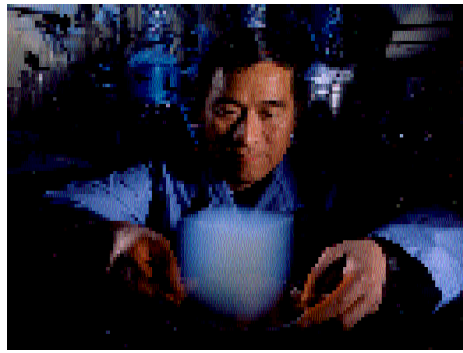
Cover: Aerogel is as delicate as a flower, yet durable enough to withstand extreme environments.

(Photograph courtesy of Ernest Orlando Lawrence Berkeley National Laboratory.)

Aerogel: The Story

Aerogel was discovered in the late 1930s. Since then, numerous attempts have been made to further understand and develop aerogel technology.

The research leading up to aerogel's use in modern applications has further exposed the remarkable physical properties of the material. Aerogel holds six "world records" for physical properties.



Aerogel, seen here as a blue cube, is being used for NASA's STARDUST and Mars Pathfinder missions.

The Cosmic Bullet Trap

The STARDUST spacecraft will be launched on a Delta rocket early in 1999. It will encounter comet Wild 2 in 2004, and return cometary samples and interstellar dust to Earth in 2006.

The STARDUST spacecraft w
launch in early 1999, capture
cometary particles, and retur
them to Earth in 2006.

When the STARDUST spacecraft flies through the comet's tail, the impact velocity of the cometary particles will be up to 12 times the speed of a rifle bullet. Aerogel's role in the STARDUST mission will be to trap these "cosmic bullets," leaving portions of them intact.

The cometary particles and interstellar dust will be stored in a capsule aboard the returning STARDUST spacecraft. As the spacecraft passes by Earth, the capsule will descend through the atmosphere and land in Utah.

On Earth, study of the tiny cometary particles may reveal information about the solar nebula from which the solar system formed, and perhaps about the role of comets in the early formation of life.

The STARDUST mission will mark the first space sample return since the missions to the Moon collected rocks in the 1960s and 1970s.

Material Made for All Humankind

Aerogel starts as a silica dioxide gel, similar to the gelatin dessert one might make at home. Then the liquid in the gel is removed without collapsing the gel (normal evaporation causes the gel to collapse). Through a process called supercritical drying, the material does not collapse but retains its original size and shape.

JPL has identified aerogel technology as a promising candidate for commercial applications. Potential applications include:

Aerogel withstands heat up to 1,400 degrees Celsius (2,552 degrees Fahrenheit)

In Walls — Aerogel is a
mable alternative to cu
sound insulation mater

In Windows — The "se
aerogel, with its high t
insulation properties, c
money by lowering uti
and winter.

In Transportation — Using aerogel for thermal insulation in airplanes can reduce fuel costs by making the aircraft lighter.

Contact Information

For more information about aerogel and the STARDUST mission, please contact:

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http://stardust.jpl.nasa.gov

The Jet Propulsion Laboratory (JPL), California Institute of Technology, is a lead research and development center for the National Aeronautics and Space Administration (NASA). The Laboratory has a wide-ranging charter for solar system exploration, Earth observations, astrophysical research, and technology development. JPL manages the STARDUST mission for NASA.

National Aeronautics and
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