Arlon J. Hunt's team at the University of California at Berkeley replaced the poisonous TMOS with tetraethoxysilane (TEOS) and replaced the methanol portion of the process with CO_2. CO_2 is nonexplosive and it needs to be heated to only 31°C for drying. The alcohol/CO_2 exchange step in Hunt's method, however, takes much longer than Teichner's original technique.

In Ludwigshafen, Germany, a team at BASF sprays an acid and water-glass solution from a mixing jet into a flask, creating aerogel pellets instead of tiles. The pellets are only a few millimeters in diameter, but they are much less expensive to manufacture than aerogel slabs of comparable density (200 kg/m^3) and can still be used for many insulating purposes.

Kistler's original work established the thermal properties of aerogels. In the late 1960s, M. Kaganer in Moscow, working for the All Union Scientific Research Institute of Oxygen, Cryogenic, and Compressor Machinery Construction, provided more detailed analyses of aerogel thermal conductivities. From about 1982 to 1987, Jochen Fricke and his group at the University of Würzburg, Germany, also studied the thermal properties of aerogel materials. One of Fricke's colleagues, Ove Nilsson, discovered that the thermal conductivity of an aerogel changes when the sample is compressed.

Thermal conductivity research has shown that double-paned windows filled with transparent aerogel would insulate three times better than double-paned silver-coated glass filled with argon, which was the best window system previously developed.

Fricke and his group also discovered some interesting acoustical properties of aerogel materials. In 1984, they used a piezoelectric transducer to send pulses of ultrasonic waves through silica aerogel samples. They were surprised to find that the speed of sound was only 100 to 300 m/s in the aerogel, while ordinary silica glass transmits sound at 5,000 m/s. Such low sonic velocities are normally found only in highly compressible materials such as rubber.

Shortly thereafter it was found that the speed of sound decreases further when the aerogel is subjected to mechanical stress—exactly the opposite of the behavior of most solids. With its low density and low speed of sound, an aerogel could be used to improve devices that emit ultrasonic waves to gauge distances, such as auto-focus cameras. An aerogel coating on a ceramic piezoelectric transducer, acting as a buffer between the air and the transducer, could increase the ultrasonic energy emitted by the transducer by as much as a hundred times.

In 1986, Dale W. Schaefer and coworkers at the Sandia National Laboratories in Albuquerque, New Mexico, found that the structure of aerogels was fractal, or self-similar at different scale lengths. In the last several years, other systematic investigations (R. Vacher, T. Woignier, and J. Pelous at the University of Montpellier, and E. Courtens at the IBM Zurich Research Laboratory) studied how aerogel fractality changes with the concentration and pH of the starting solution. Indeed, much current aerogel work focuses on finding better ways to control the microstructure of aerogels as they form.

Since the resurgence of aerogel work in the past 25 years, much progress has been made. Analysis of the delicate gel body has resulted in intriguing properties with a broad range of possible commercial and research possiblities. When researchers Ian Thomas, Lawrence Hrubesh, and Thomas Tillotson at Lawrence Livermore National Laboratory announced the creation of a new silica aerogel with a porosity of 99.9%, they received over 400 phone calls from various entrepeneurs. Already, the commercial applications suggest not only efficient window insulation and particle detectors, but also high-resolution sound sensors, film industry special effects, fire retardants in buildings, and toy or novelty items. One sign manufacturer wanted to use aerogels as a background material for massive, extremely light signs that would look like letters floating in the sky; an entomologist studying the behavior of borer bees suggested using aerogels as a hive material, which would allow him to observe all their activities inside the hive. No doubt these will be only a fraction of the ways aerogel materials will be used when larger quantities of inexpensive aerogels become available.

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