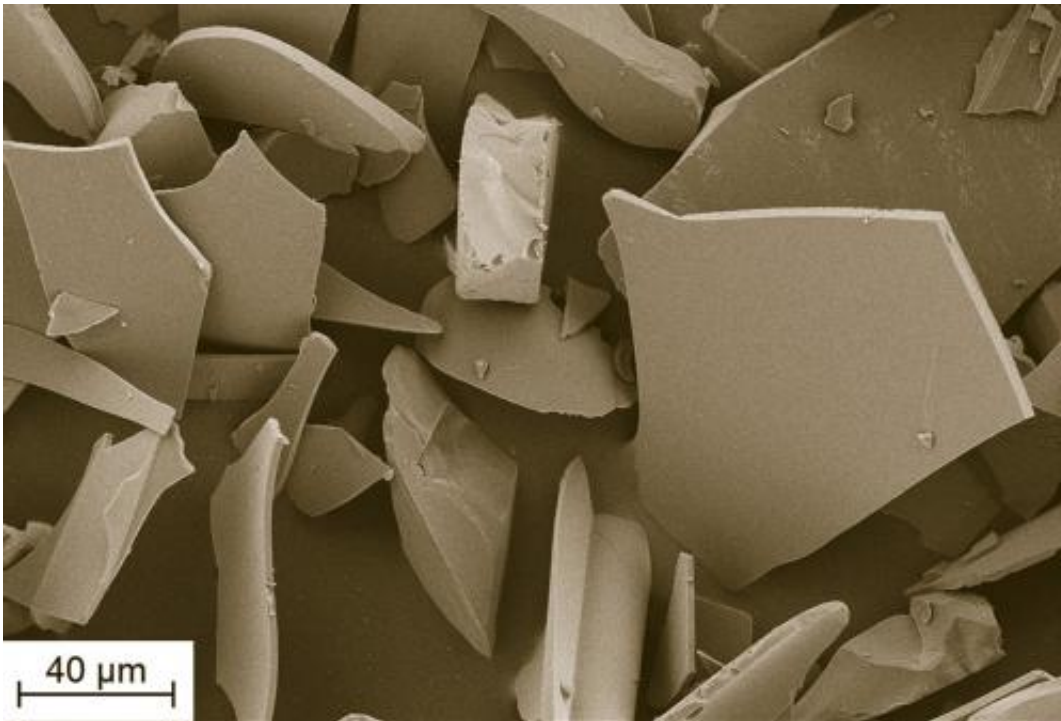


Comfortable climate indoors with porous glass

July 31 2014



Scanning electron microscope (SEM) image of glass flakes. Credit: Fraunhofer ISC

Proper humidity and temperature play a key role in indoor climate. In the future, establishing a comfortable indoor environment may rely on porous glass incorporated into plaster, as this regulates moisture particularly well and keeps mold at bay.

Almost nothing worries tenants and homeowners more than mildewed or moldy walls. The black spots are not just ugly; they also pose a danger to people's health. More than anything else, stringent insulation standards governing living spaces can lead to more moisture, which is the main cause of mildew or mold. In 2002, the German federal government brought in energy saving regulations stating that the external components of new and renovated buildings must be made air-tight to ensure that as little heat as possible escapes. The flip side is that excess moisture becomes trapped inside. "That's why humidity-regulating materials are becoming increasingly important," says Ferdinand Somorowsky, researcher at the Fraunhofer Institute for Silicate Research ISC in Würzburg.

Particularly fast water absorption

In collaboration with Bayreuth University and the company Keimfarben GmbH, the researcher and his team are developing supplements for paint and plaster that have a compensating effect on indoor climate and humidity in particular. The project partners have selected artificially manufactured porous [glass](#) for the additive because the inorganic material's pore size, volume and particle form can be selectively controlled – an advantage the naturally occurring alternatives don't offer. Particular attention was paid to glass particles in their flake form, since they have the ability to very quickly absorb, store, and then slowly release moisture. "As invisible vapor, there is always water in the air. A pleasant indoor climate only remains pleasant when excess moisture released into the room's air by showering, cooking and sweating can also dissipate again somehow. Walls and ceilings offer large surfaces that could be used for moisture management – and by adding glass particles to plaster, stucco and paint, we can even out daily and seasonal humidity differences. The result is a simply more comfortable living space. Up to now, between 95 and 98 percent of all plasters available have been without additives," explains Somorowsky.

The glass particles are based on Vycor® glass. With this glass type, pores form when manufactured in a certain way; adjusting the process parameters allows for selective modification of the pores. In addition to round shapes, these glass particles can be manufactured in fiber or flake form, while other materials with absorption properties, such as zeolite or ceramic, can't be. Filler material can be produced with a pore size ranging from between just a few nanometers to several micrometers. "Since porosity and pore size can be exactly specified, we can also regulate humidity effectively. A minimal change in pore size adapts the material for different temperatures and various applications, such as living areas, rooms with consistently higher humidity or basement rooms," says the researcher.

Porous glass is inexpensive, non-toxic and non-combustible; for the preliminary tests, it was successfully manufactured in large quantities of several hundred kilograms.

In practical testing, researchers demonstrated that, in comparison to other materials used for regulating humidity, such as zeolite or fiberboard, the glass flake and plaster mixture can absorb considerably more moisture and then release it all again. Tests were conducted at a constant temperature and humidity based on a typical indoor climate. In follow-up tests using benchmark plasters, the inorganic material proved itself superior. As humidity increased, the mass of the glass-flake infused plaster increased more and consequently absorbed more water compared to the reference materials. "In a room with a volume of 30 cubic meters, the walls and ceiling offer approximately 40 square meters of surface area that could be used for a moisture regulating plaster. In order to reduce the humidity from 72 % to 47%, some 180 ml of water needs to be absorbed. And our glass flake plaster can actually adsorb more than a half liter of water," says Somorowsky. Mold spore inhibitive substances can be added to the plaster as well.

Another positive effect of the porous glass flakes is their influence on the building's energy balance. In cases of high humidity, water is adsorbed on the glass surface. The energy released makes the room drier and warmer. The opposite occurs with low [humidity](#), when desorption cools and humidifies the room. These processes take place in both winter and summer, which saves primary energy for heating or cooling. The evenly dispersed glass flakes in the plaster layer particularly benefit the [indoor environment](#) during heating.

Currently, the project partners are examining how the glass-based material functions under additional paint layers and wallpaper. They estimate that it will take another two years before the environmentally friendly, moisture regulating plaster reaches the market.

Provided by Fraunhofer-Gesellschaft

Citation: Comfortable climate indoors with porous glass (2014, July 31) retrieved 6 May 2024 from <https://phys.org/news/2014-07-comfortable-climate-indoors-porous-glass.html>

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