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1 *Finely crushed glass flakes with defined porosity*

POROUS GLASS FLAKES

IN BUILDING MATERIALS AND WALL PAINTS

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Moisture and temperature management

In modern buildings, energy consumption but also health, well-being or subjective comfort are dependent on optimized construction materials. This is why consumers nowaday expect sustainable building techniques and environmentally friendly and healthwise uncritical materials.

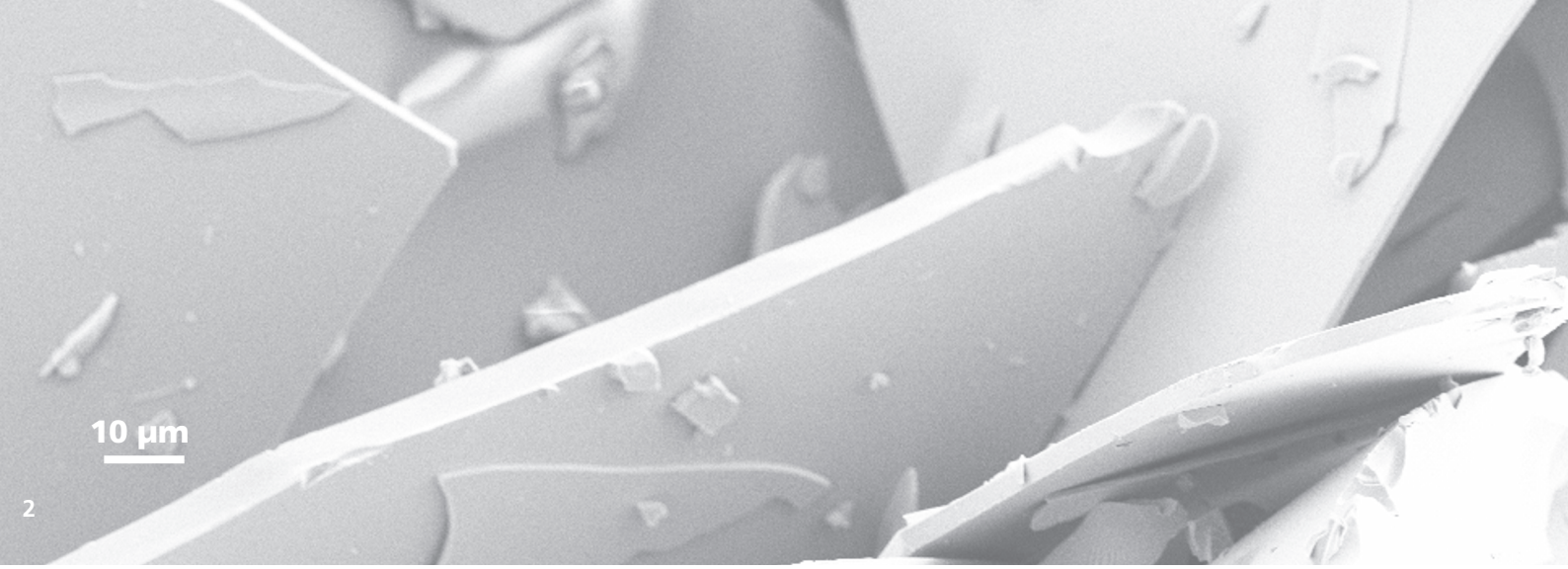
Present-day building physics must accomodate for this by providing suitable thermal and humidity management solutions. It is a fact that standards for building insulation are continuously rising, coupled with airtightness of the building envelope, can lead to humid indoor situations fostering the growth of mould. Therefore, the use of construction materials with moisture-regulating properties is of increasing importance.

In buildings, walls and ceilings offer enough space which potentially could be used for moisture management. Best suitable materials are inorganic based systems of a certain porosity. They can be integrated in wallpapers, paints, plasters or gypsum to buffer the fluctuations in moisture occurring over the day or over the year.

A wall coating that can reversibly absorb and release water offers the clear advantage of a higher subjective feeling of comfort through less pronounced daily fluctuations in air humidity. In addition, heat will be absorbed or released which can save energy.

Porous glass flakes as moisture gatherer

Among the suitable inorganic materials are (natural or synthetic) zeolites and synthetic porous glasses and ceramics. The advantage of synthetic materials over natural ones is the ability to tailor and optimize specific features such as pore volume, pore size and particle shape. Also, extras can be added, such as doping with mould inhibi-



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tors. It is also possible to bring ceramics into a porous state via a special sintering process. The so-called Vycor® process can be used to produce porous glasses. After a specific temperature treatment (spinodal phase decomposition) it is possible to leach out the instable phase leading to a pre-defined pore size and volume.

The advantage of Vycor® glass compared to ceramics lies in the easy mouldability during manufacturing. In addition, fibers or powder particles of regular spherical geometry, glass flakes with thicknesses of 1-20 µm and diameters of 10-500 µm can be also manufactured.

The glass flakes can be incorporated as filling material into paints with a significantly higher volume proportion than isotropic particles. The material is reasonably priced and producible in large quantities – aspects that render the product equally attractive for applications in the construction sector.

Filling material development

In a project funded by the Bavarian Research Foundation, porous and glassy filling materials were developed. The materials can be integrated in paints, plasters or gypsum for the climate management of living and office spaces (moisture and temperature balance). They were developed in collaboration with the manufacturer Keimfarben GmbH. The glasses were produced in batches of several 100 kg in form of powder respectively flakes. In this process, defined pore sizes between just a few nanometers and up to several micro meters were manufactured and optimized for respective requirements.

The material shows a highly reversible moisture absorbent capacity which remains large even after the integration in paints or plasters.

Energy savings and living comfort

Model calculations as well as practical tests show that materials which were modified accordingly do not only have substantial impact on the energy balance of buildings but also increase the living comfort at the same time. Furthermore, additional active functions such as anti-mould or catalytic properties can be easily integrated into porous glass.

Data and characteristics

- Adjustable porosity, pore size and specific surface
- High absorption and desorption rates
- Non-flammable
- Reasonably priced
- Non-toxic
- Stable up to > pH 12
- Flake diameter 10 – 500 µm
- Flake thickness 1 – 20 µm
- Pore size 1 – 50 nm
- Water absorption of up to 30 percent mass fraction (at 20 °C room temperature and 74 percent relative humidity), corresponding to approximately 65 percent by volume.

2 *Electron micrograph of porous glass flakes manufactured via the Vycor® process*