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New building material with micro-encapsulated phase change materials

Together with industrial partners, the Fraunhofer Institute for Solar Energy Systems, ISE, developed building materials with micro-encapsulated paraffin. This wax-like additive greatly increases the thermal storage capacity of the indoor plaster and the dry building panels. A wall of 3 cm thickness has the thermal comfort of a concrete wall with a thickness of 40 cm. Thus,in summer the room remains at a pleasant temperature, and in winter the room does not cool down as quickly.

Whoever has at one time burned their hands with liquid wax has experienced how much energy it contains. Physicists speak of this as latent -- or hidden -- heat. When solid wax melts, the temperature of the melted wax remains the same regardless of how hot the energy input is. The input energy is required to break the molecular bonds between the wax molecules. In liquid wax this bond energy is stored as latent energy and first during solidification is set free as heat. This substance acts as a heat accumulator that primarily makes use of the phase change process from solid to liquid rather than the temperature. Therefore one speaks of Phase Change Materials, or PCM.

How can this material be technically applied? "The most obvious application is increasing the thermal capacity of common building materials," mentions Dr. Hans-Martin Henning, project leader at Fraunhofer ISE. "In principle, however, PCM can be used wherever a large heat storage capacity is desired, for example in heat exchangers, heat carrier media or heat accumulators. By the production, the temperature range of PCMs can be set between -10 and +80°C. A hot-water boiler with PCM would only be about half as big as a conventionally sized boiler and the water would stay warmer longer."
Using PCM on the indoor walls serves as an environmentally friendly climate control and functions as follows: When the indoor temperature rises above 22°C, the wax begins to melt and takes away the heat from the room without becoming warmer itself. Using night ventilation, the wall is "discharged" and on the next day can provide a cooling effect in the room. In many cases with such a system, conventional air-conditioning becomes unnecessary. This saves energy as well as protects the environment.

In the present project on the development of lightweight building materials, micro-encapsulation plays an important role. PCM cannot be directly put in contact with the building material since the melting wax would negatively influence the material characteristics. Therefore, BASF AG supplies the PCM in the form of little microscopic balls having a diameter of 1/50 mm. The PCM does not come into direct contact with the surrounding building material. A further advantage of the encapsulation is the size of the inner surface area. The heat can be transferred very quickly from the ambient into the PCM.

Three other industrial partners also develop building materials with micro-encapsulated PCM: The company Maxit is working on the topic of plaster and plaster products, the Caparol Firmengruppe/ Deutsche Amphibolin Werke is working on paints, fillers and plasters and Sto AG is working on foam glass panels.

Fraunhofer ISE characterises the material samples, investigates the effect on buildings with the help of numerical simulations and assists with demonstration projects. The researchers themselves forge ahead with a good example: In the new building of Fraunhofer ISE, three offices will be implemented with three different PCM building materials.

By the end of the year, such lightweight building materials will be available on the market. The advantages of these materials should be taken seriously.

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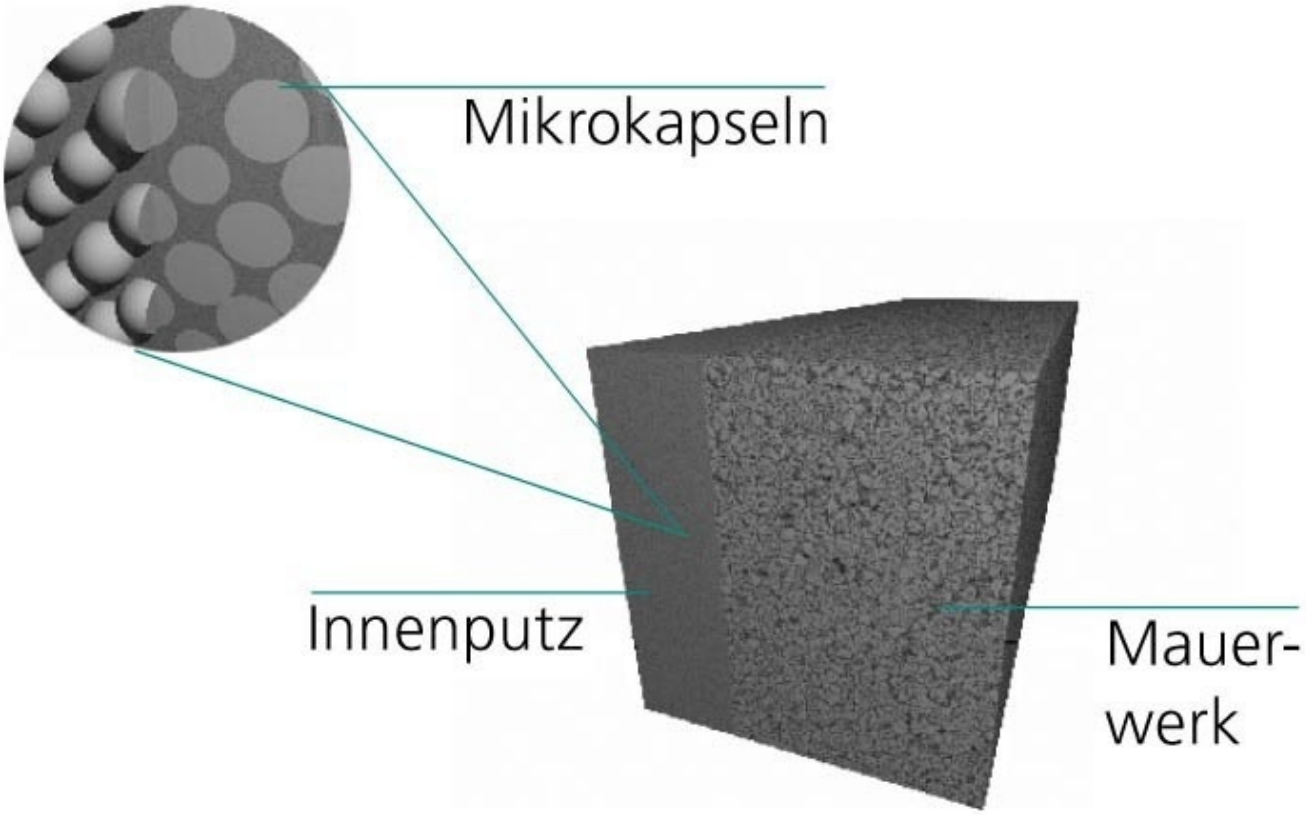

Principle of a micro-encapsulation / Phase-change material in plaster on inside wall