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Carbo-Thermal-Active – Carbon based, conductive plaster base as an active, thermal activation of building envelopes

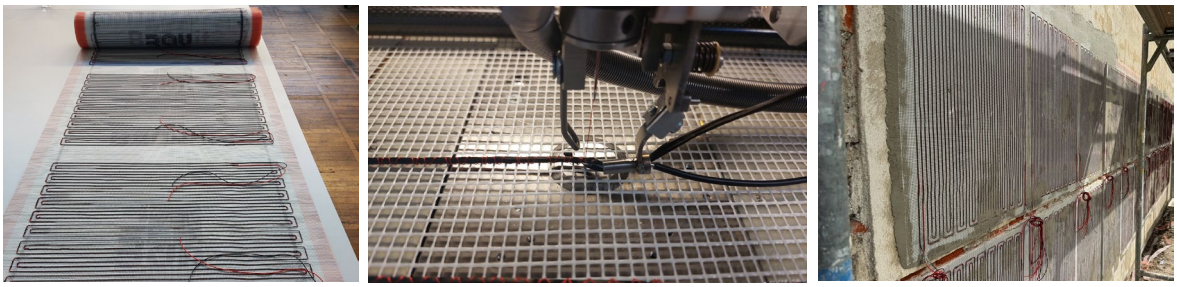
Objective

The partial elimination of thick, conventional thermal insulation is to be achieved through active, sensor-monitored thermal activation (TA). Heating elements made of carbon fibre rovings integrated into the plaster base are used in conjunction with temperature sensors to reduce the heat flow from the interior to the exterior of the building during the heating season at very low temperatures. As the wall thickness is no longer based on the lowest outside temperature, the wall thickness can be reduced by reducing the amount of insulation. This provides benefits in confined spaces, improves light through windows and increases cooling of the building at summer nights.

Approach and results

For this purpose, the thermal activation is positioned close to the outer surface of the building. The solution therefore focuses on thermal activation using electrically conductive grid structures, which are inserted into the outer plaster layer and also act as a plaster base. The use of electrical heating elements allows precise and targeted artificial heating of the building envelope, which can be controlled in real time. During the summer months, the reduction of the thermal insulation layer leads to an improvement in the cooling of the building during the night.

Thermal activation is achieved using stick technology. Parallel circuits are preferred. The electrical supply and return lines must be brought up to and contacted with the PTC thermistors applied in the embroidery process. In order to reduce the harmful contact resistance at the transition, a process was developed in which the heatsealing band is first embroidered and then an overlap of at least 100 mm with the PTC thermistor is achieved using embroidery technology. The functional reliability of the junction was then verified in laboratory tests.



Component for thermal activation (left), in the manufacturing process using embroidery technology (centre) and in use on a wall (right; © Hubertus Kieslich)

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