Entwicklung und Erprobung eines auf Metallschaum basierenden Systems (Demonstrator) zur regenerativen Nutzung und Speicherung von Abwärme aus Energiegewinnungsprozessen - Mstor

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Projektleitung: Aron Kneer, TinniT Technologies GmbH, 76133 Karlsruhe

Partner: engtec GmbH, 78713 Schramberg-Waldmössingen
Institute of Materials and Processes, Hochschule Karlsruhe – Wirtschaft und Technik, 76133 Karlsruhe

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Utilization of the heat usually accumulating as a byproduct of electric energy generation could improve the efficiency of the respective overall systems. Utilizing the phase changes of certain media, latent heat accumulators can store relatively large amounts of heat but are too slow regarding its conduction. The idea is thus to fit the latent heat accumulator with an accelerating additional inner metal structure. Using that method, the high capacity of paraffin could be combined with the rapid heat transfer of metal. A suitable storage concept was developed and the subsequently manufactured accumulator was integrated into an existing combined heat and power plant. To lay the numerical foundations for designing similar systems in the future, the collected data, in addition, were used to create a suitable simulation environment. For reasons of scalability, the calculated total storage capacity was divided into six individual modules. To obtain the most efficient solution, each module was analyzed regarding different heat conduction design layouts. Low-cost alternatives such as open-cell metal foam and aluminum wool or aluminum bridge inserts were investigated further. In addition, the heat penetration behavior was analyzed by the example of open-cell metal foam and was modeled numerically. It was found that under defined conditions, commercially available CDF solvers show good agreement between measured and calculated temperature curves and are suited for appropriate calculations. Both the results obtained and the recalculations made on the basis of the optimized simulation models served to design a demonstrator as mobile storage system i.e., as hybrid accumulator with water-immersed individual modules. A near-series compact self-sufficient prototype has been manufactured in the meantime for all kinds of applications.