Karlsruher Institut für Technologie

Heat | Hydrogen | Resilience

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Master Thesis

Numerical simulation of a heat exchanger from additive manufacturing processes

Additive manufacturing ("3D printing") enables heat exchangers with completely new designs and immense optimization potential. The resulting smaller design in turn reduces the CO2 footprint in production and implementation, accelerating decarbonization across the board.

As part of a master's thesis, such a heat exchanger model from a well-known industrial partner is to be calculated using CFD and the advantages over a classic design are to be worked out. The boundary conditions are adapted to a specific application in order to be able to use the heat exchanger in a future system.

Particularly high demands are placed on the design of the heat exchanger when using low-temperature heat. The aim is usually to achieve a good compromise between low-pressure loss and low coarseness in order to transfer the maximum amount of heat at the highest possible temperature. Size, price and fouling or scaling are further aspects when choosing a suitable design.
New additive manufacturing processes now offer the possibility of producing complex three-dimensional structures (printed circuit heat exchangers, triple periodic minimal structures - TPMS) instead of the classic design with structured tubes or plates.
The work includes in detail
- Literature research
- Familiarization with the CFD software STAR CCM
- Creation and integration of a heat exchanger model
- Carrying out transient or steady-state calculations for various operating cases
- Summarizing, interpreting and evaluating the results
- documentation

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