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Dynamic Analysis of Thermochemical Heat Transformers for Industrial Heat Recovery

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Extended Abstract

A significant part of the energy consumed by industries is always wasted as low-, medium-, or even high-temperature heat. Therefore, extensive waste heat recovery across the industrial sector is essential to improve sustainability and energy efficiency of the sector. But due to the mismatch of the available and needed temperatures, as well as low quality of low-grade waste heat streams which is the most common case, temperature upgrading is required to take practical advantage of these. Thermochemical heat transformer (TCHT) technologies have been introduced as a promising technology for waste heat recovery and temperature lifting in industries. Among the different types of TCHTs, systems based on gas-solid chemical reactions offer significant advantages, including high heat storage capacity and scalability. As part of TechUPGRADE project, together with several leading commercial and academic partners across the EU, we are developing and promoting a cutting-edge continuously operating solid-gas TCHT. The proposed system uses SrBr2.H2O as the working pair because of its stable chemical properties and high heat storage capacity. This study presents a dynamic modeling of the proposed system, and its dynamic operation impacts on the chemical reactions and overall performance of the machine in heat boosting. For this, the system is programmed in Modelica, and its performance is dynamically simulated to track the progress of chemical reactions in hydration and dehydration reactors. Overall, the research shows that the proposed TCHT performs dynamically quite acceptable and thus has the practical potential to play an important role in low to mid-temperature range waste heat recovery and upgrading in industry. Dynamic modeling of this system provides also valuable insights to improve the design and performance of the system even further to possibly make its impact in enhancing energy costs, energy efficiency, and sustainability.

The reference section at the end of the paper should be edited based on the following:

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