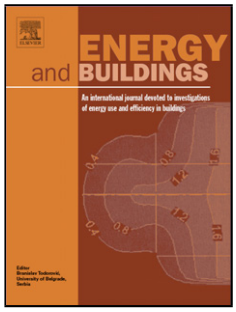

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<AT>1.1 The concept of cascade thermochemical storage based on multimaterial system for household applications

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<ABS-HEAD>Highlights► The concept of cascade thermochemical storage with multimaterial system is analysed ► The cascade design may help improving the energy storage density and the storage cost ► The cascade design may also help improving the energy and the exergy efficiencies ► Attention should be paid to the cost when selecting the subsequent materials ► Depending on the target, the selected materials would differ for the same application

<ABS-HEAD>Abstract

<ABS-P>Despite significant progresses, thermochemical heat storage technology is still not mature. However, significant improvements may be realised when looking at the application side and the thermodynamics possibilities and constraints of the system. In this paper, the possible advantages of a cascade thermochemical thermal storage are analysed, with an emphasis on long-term solar thermal storage for building applications. It appears that a cascade design may help improving the energy storage density, the energy storage cost, the energy and the exergy efficiencies. An application of the developed analysis is presented by a case study. The objective was to design a seasonal solar thermal energy storage for domestic hot water and heating, based on salt hydrates and with high heat storage density. The given constraints lead to $Na_2S{\cdot}5H_2O$ and $SrBr_2{\cdot}6H_2O$ as storage materials. The study shows an increase in the energy storage density of 11% to 21%, depending on the operation strategy, while using a cascade (two materials) instead a classical storage system using a single material. The useful exergy efficiency is also increased from 22% to 27 %. However, the cascading results in an increase in the energy storage cost, due to the high cost of the $SrBr_2{\cdot}6H_2O$. This indicates that attention should be paid to the cost when selecting the