Improving heat recycling with the thermodiffusion effect

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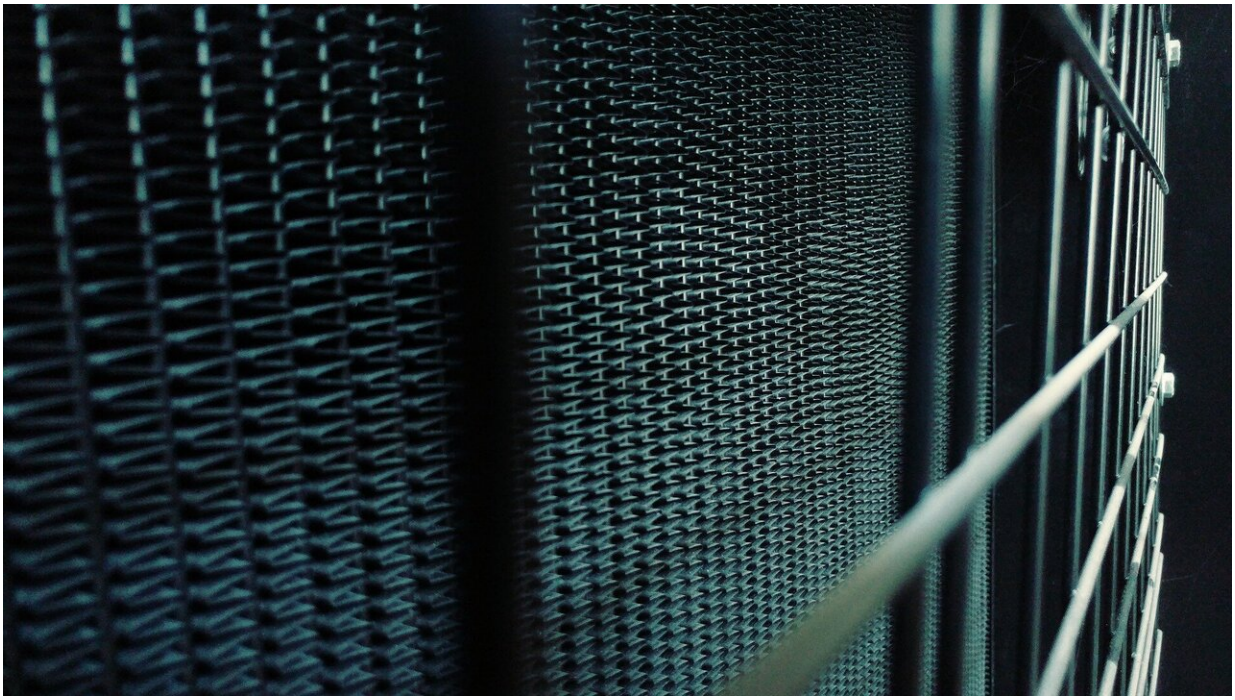

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Absorption heat transformers can effectively reuse the waste heat generated in various industries. In these devices, specialised liquids form thin films as they flow downward due to gravity. These liquid films can absorb vapour, and the heat is then extracted by a coolant so that it can be used in future processes. So far, however, there has been little research into how the performance of these films is influenced by the

thermodiffusion effect—a behaviour seen in mixtures, where different types of mixture respond differently to the same temperature gradient. In a study recently published in EPJ E, researchers from the Fluid Mechanics group at Mondragon University and Tecnalia in Spain, led by M. M. Bou-Ali at Mondragon University, pooled their expertise in transport phenomena and absorption technology. Together, they explored for the first time the influence of the thermodiffusion property on the absorption, temperature and concentration profiles of falling films.

With the industrial sector currently producing vast amounts of waste heat , the study is part of a growing effort to increase its efficiency by recycling unused heat. The researchers discovered that when the mass transfer of different mixture components varies due to the thermodiffusion effect, as is seen in a liquid with a negative thermodiffusion coefficient (water-lithium bromide), the absorption of surrounding vapours can be increased. They also found that the absorption in the films changes significantly as they flow down, due to widely varying temperatures and concentrations. The team arrived at their conclusions by incorporating a variety of thermodiffusion effect equations into numerical models, and subsequently calculating the resulting degrees of vapour absorption in the films.

Since a third of our total energy consumption is currently in industrial processes, heat exchange devices are becoming more and more important to increasing their efficiency by recycling large amounts of heat. The work, therefore, offers valuable new insights into how the performance of falling film absorbers could be improved in the future.

More information: Peru Fernandez de Arroiabe et al, On the thermodiffusion effect in vertical plate heat exchangers, *The European Physical Journal E* (2019). DOI: 10.1140/epje/i2019-11850-7

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