

Development of a plate in an heat exchanger

Anna Gunnarsson and Jenny Hoang

Division of Solid Mechanics, LTH

Lund University

The world's population is steadily increasing. While the standard of living is rising rapidly for many, the earth's natural resources are declining and large amounts of waste are being generated. Renewable energy contributes to our planet's long-term sustainability and brings significant benefits to our climate, our health and our economy. Heat exchangers plays an important role in the growth of renewable energy.



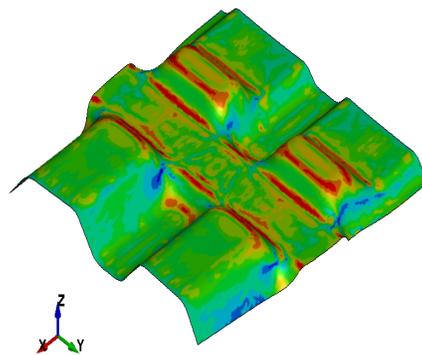
Plate heat exchanger.¹

A plate heat exchanger is using the concept of creating flow channels that separate liquids without mixing them. The plate heat exchanger consists of thin corrugated plates with a pattern that will make the transfer of heat as effective as possible. The heat exchanger have openings for two fluids.

The manufacturing of plates in an heat exchanger consists of a few steps. From the supplier, a rolled coil or sheet metals are prepared. The coil is cut to the dimensions of the chosen plate to prepare for forming. To make the forming process easier and to minimize the wear of the press tool the cut metal sheets are lubricated. The pattern of the press tool is meticulous designed to maximize the efficiency but still keep the thinning reasonable. After forming, the final step is to wash of the lubrication before mounting the plates in a heat exchanger.

When developing a new plate for a heat exchanger, the main task is to optimize the plate for higher efficiency. The most common way to analyse a plate is to use virtual tools. Simulations in software with finite element analysis implemented, is both cost and time efficient compared to other methods, for instance physical tests based on trial-and-error. However, the accuracy and precision of the

simulations is highly dependant on the constitutive model describing the behavior of the material. Material models are used to estimate material behavior, and for a formed plate, material phenomenon such as springback and necking are important to consider during this type of analysis.



Result from forming simulation of the plate.

The simulations were performed in two different software, where one of the software did not work due to bugs. The analysis was divided into three simulations where the setup was modified to capture a bigger scope of the material behavior. The second software could handle all three simulations with a successful result including the material history.

To further develop this method, the analysis needs to be supplemented with physical tests to draw any conclusion on whether the new setup was more accurate or not. The new methodology is more expensive but will hopefully get an approximation closer to the real result.

[1] Alfa Laval, 'Packningsförsedda värmeväxlare', accessed 2021 february 15, <https://www.alfalaval.se/microsites/packningsforsedda-plattvarmevaxlare/>