

# Modelling of Heat Transfer in Different Materials in Cooking Vessels Using COMSOL

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## Abstract

Cooking vessels are traditionally made of metals with high thermal conductivity, and mainly made out of aluminium, copper or stainless steel etc. With the wide availability of many different materials for making cooking pans, the project aims to investigate the contribution of the material of a cooking pan to heat transfer efficiency of the pan and determine the best material for a cooking pan. This will allow product designers, chefs, and home cooks to best understand which material to use for creating a cooking vessel, or which vessel to pick for cooking. The materials used were Steel AISI 4340, Aluminium, Aluminium 6063-T83, Titanium beta-21S, Iron, Copper, Cast Iron and Structural Steel.

The use of COMSOL physics modelling software eradicates heat lost to the surroundings and human error during experimentation, allowing for a more transparent and direct comparison of the thermal conductivity of different materials used in a cooking vessel. It also allows for a faster derivation of results. To achieve this, a simulation model was created for heat transfer analysis and variables such as temperature change across the length of the model were investigated.

The Heat Transfer Module was mainly used in this project. A 3D geometry resembling a pan using built-in geometry software was created. The geometry of an ellipsoid was modified to resemble a typical cooking pan. Work planes were then used to delete the partition objects to simulate the cooking pan. Different materials were added to the geometry itself, then conducting the study to obtain the results.

The results demonstrated that Copper transfers heat the most efficiently. Temperature distribution is more even in Copper as well. Results obtained demonstrated copper as the most suitable material used for creating a cooking vessel.