Modelling of Heat and Moisture Transport in a Corrugated Board Stack

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Abstract

Corrugated board is produced on a machine where the corrugated medium is glued between two flat paper surfaces, the liners. The board is cut into sheets and stored in a stack until suitable moisture content has been reached. The sheets are then cut and creased into blanks for the production of boxes and other products. If the moisture content is too high, there is a risk for cutting problems in the converting process. On the other hand, too low moisture content will increase the risk for scoring cracks.

The objective of the study is to investigate the moisture and temperature transport inside the cell of the corrugated board when the stack is placed in the storage.

The simulation of the cell is resolved by using the COMSOL Multiphysics® software. It is modelled by three dimension geometry, having literature dimensions and computed with a time-dependent solver until reach steady state. Furthermore, the physics set of equations used are the Heat transfer, Transport of Diluted Species for moisture and vapor concentration and Brinkman Equations.

Different variables gradient are applied in the model in order to observe the behavior of the cell by calculating the fluxes. In every simulation the gradient is applied only in one direction of the 3D model. As it was expecting, the fluxes increases linearly as the gradient increases. Moreover the fluxes are higher in the axis where the gradient is applied. With the purpose of verifying this conclusion, the tensors of the transport coefficients are calculating.

Figures used in the abstract

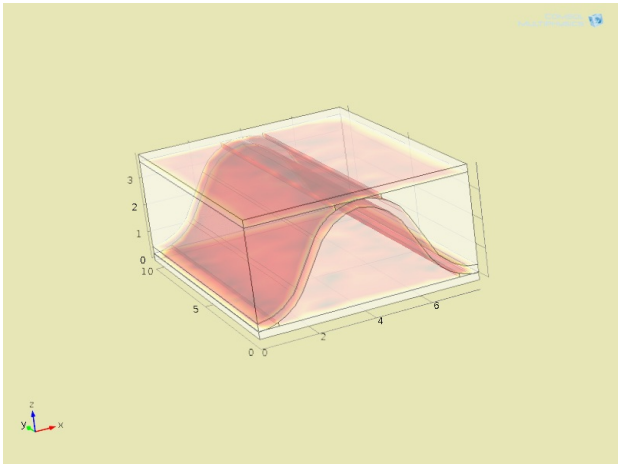

Figure 1: Detailed cell of the corrugated board