

# Working with Composites

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# “Studies of the Hot-Pressing Operation and Cure of Medium Density Fibreboard (MDF)”

PhD Thesis, LEPAE-DEQ-FEUP, 2002  
(Supervisors: Prof. Carlos Costa and Prof. Mário Rui Costa)

- Modelling and Experimental Study
  - Conventional Hot-Pressing Process
  - HF heating process
  - Continuous Hot-pressing process
  - Models validation

## Studies of the Hot-Pressing Operation and Cure of Medium Density Fibreboard (MDF)

**MDF** is a wood-based panel manufactured from wood fibres with a synthetic adhesive through a hot-pressing process

Press {  
batch  
continuous

Heating {  
Conduction  
Steam injection  
HF/microwaves



Characteristics:

Uniform appearance  
Isotropic and homogeneous structure  
Resistance to flexion and traction  
Dimensional stability  
Excellent workability

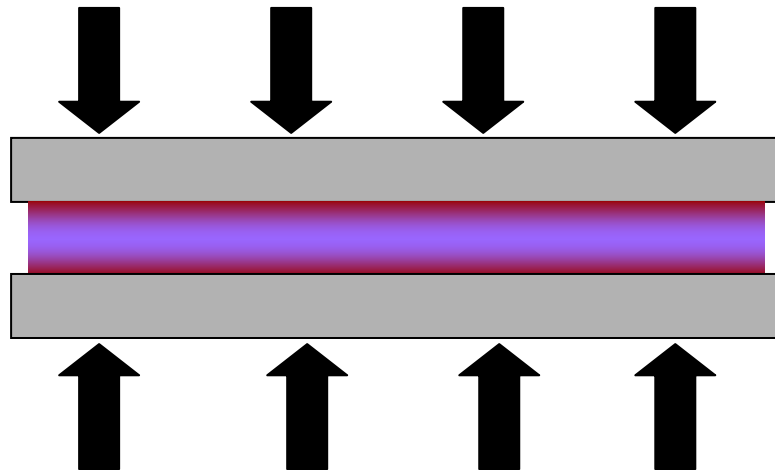
Applications: **furniture**  
**construction**

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## Studies of the Hot-Pressing Operation and Cure of Medium Density Fibreboard (MDF)

### The hot-pressing process of MDF



#### Mechanisms involved:

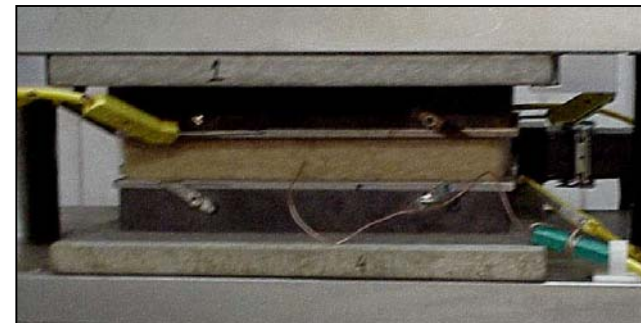
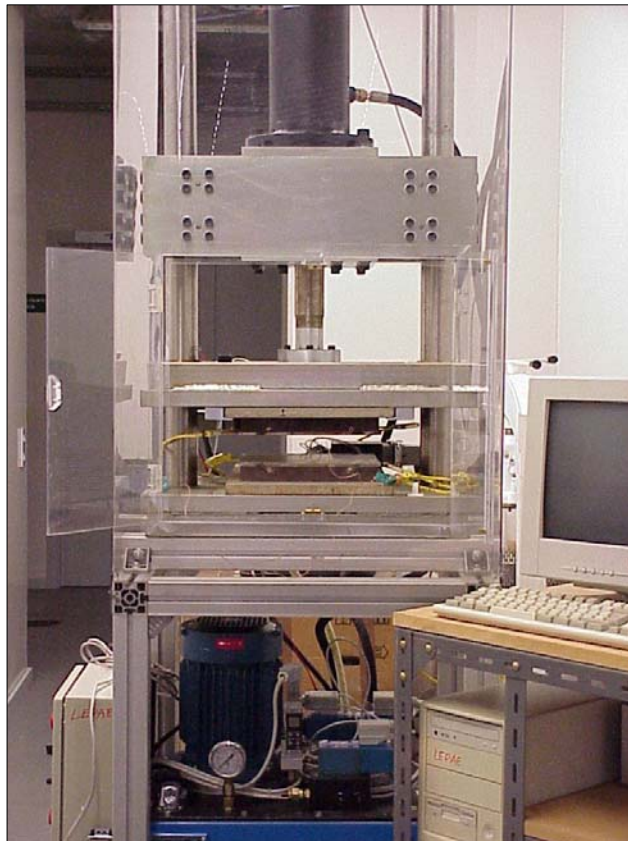
1. Heat transfer  
Conduction and convection
2. Mass transfer  
Convection and diffusion
3. Phase change of water
4. Resin cure
5. Viscoelastic behaviour of the wood fibres & resin system
6. Transversal compression  
Densification & stress relaxation

FORMATION OF A VERTICAL DENSITIES PROFILE

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## Studies of the Hot-Pressing Operation and Cure of Medium Density Fibreboard (MDF)

### Experimental work



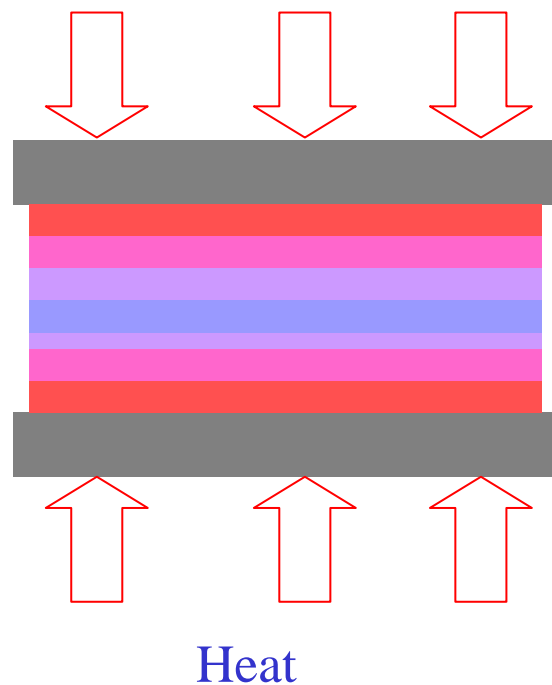
Press at LEPAE: constructed during the PhD

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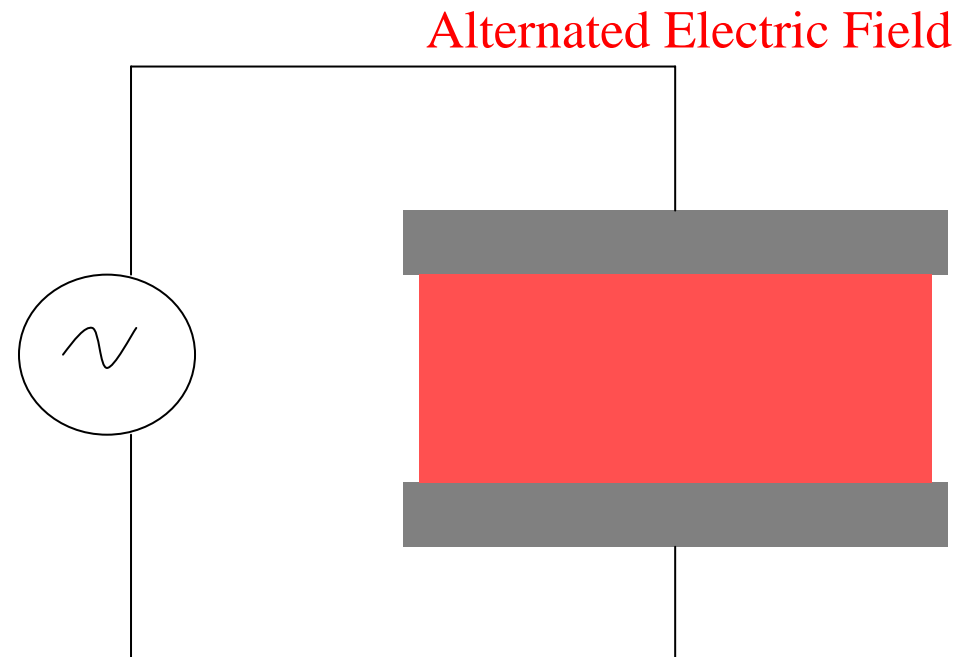
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## Studies of the Hot-Pressing Operation and Cure of Medium Density Fibreboard (MDF)

### HF/MW Heating of MDF



Conventional heating process



The heating rate depends of the dielectric properties of the material and of the radiation frequency

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## Studies of the Hot-Pressing Operation and Cure of Medium Density Fibreboard (MDF)

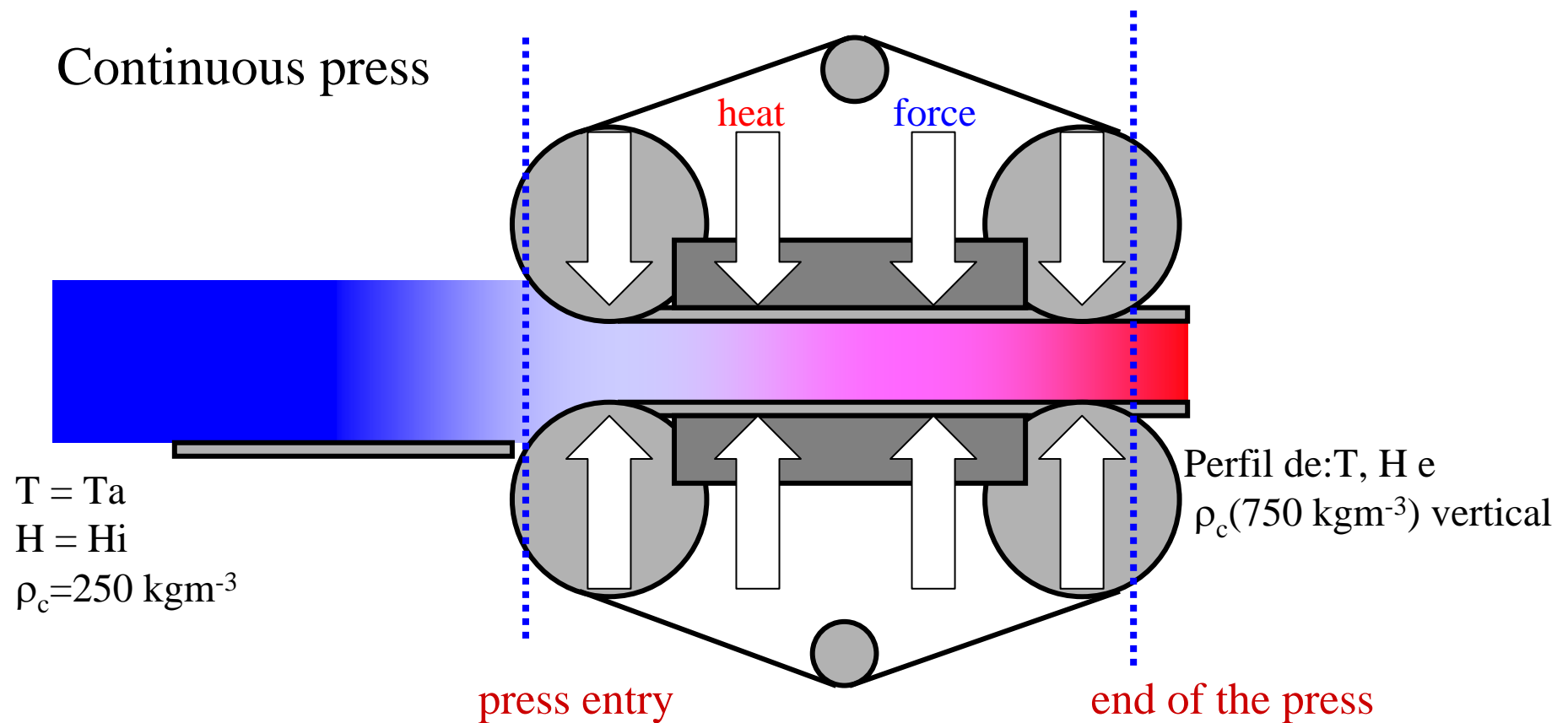
### HF/MW Heating of MDF: Experimental work



HF heating machine (SAIREM) at CTBA

## Studies of the Hot-Pressing Operation and Cure of Medium Density Fibreboard (MDF)

### Modelling the continuous pressing process



The description of all the phenomena involved corresponds to the modelling of a porous heterogeneous media in movement



## **Post-Doc work at INEGI**

# Modelling RTM process (Resin Transfer Moulding) for clay/resin nanocomposites

(Supervisor: Prof. António Torres Marques)

**Unsaturated polyester/clay nanocomposites**

**Epoxy/clay nanocomposites**

**Objective 1: Improve fire/smoke behavior with minor effects on mechanical properties**