



# Effect of different natural insulation products' density in relation to thermal conductivity

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COST FP1303

30<sup>th</sup> – 31<sup>st</sup> August 2016

Poznan Poland





## Introduction

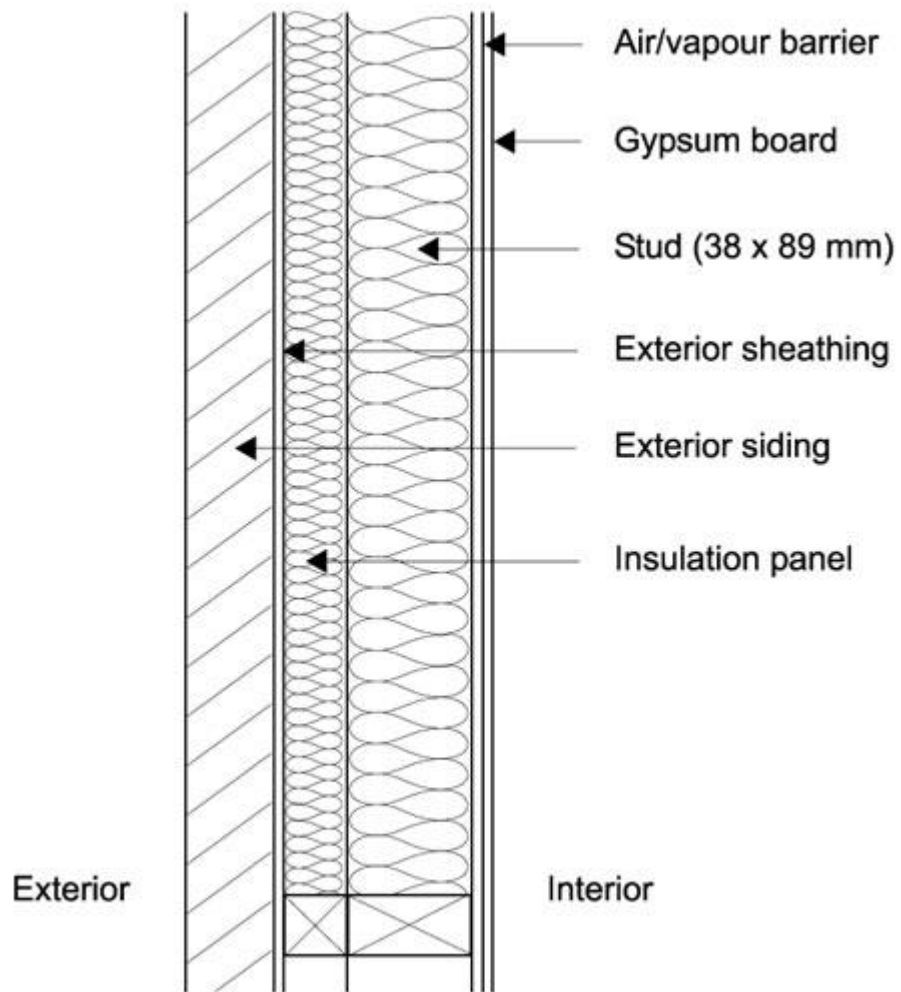
- The use of alternative bio-based materials in building is on the increase.
- Biobased materials can be used as individual components or as part of integrated panels.



## Standard wall building

- A simple wall concept is the multilayer approach
  - Sheathing – e.g. wood/brick/blockwork
  - Structural elements
  - Vapour barrier
  - Cavity insulation
  - Ideally breathable but water resistant





## Biobased insulation

- Biobased insulation materials are commercially available
- Internal or external insulation
  - Fibrous internal?
  - Hemp/lime internal or external?



## Insulation Materials

- Sheep's wool mat
- Mineral wool mat
- Wood fibre insulation
- Hemp insulation
- Hemp/lime insulation



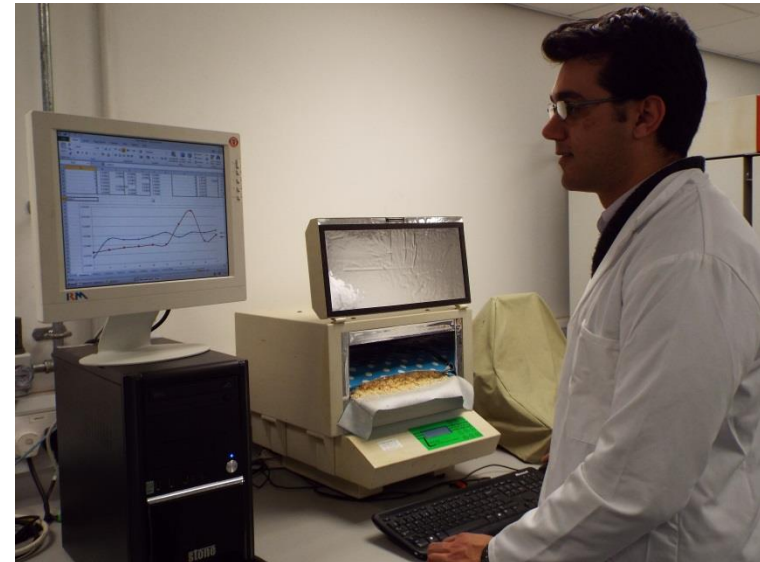
## Integrated construction panels

- Prefabricated construction panels could be made incorporating all elements of traditional walls
- Utilise biobased materials
- Insulation can be bulky so can it be optimised for use in an integrated panel.



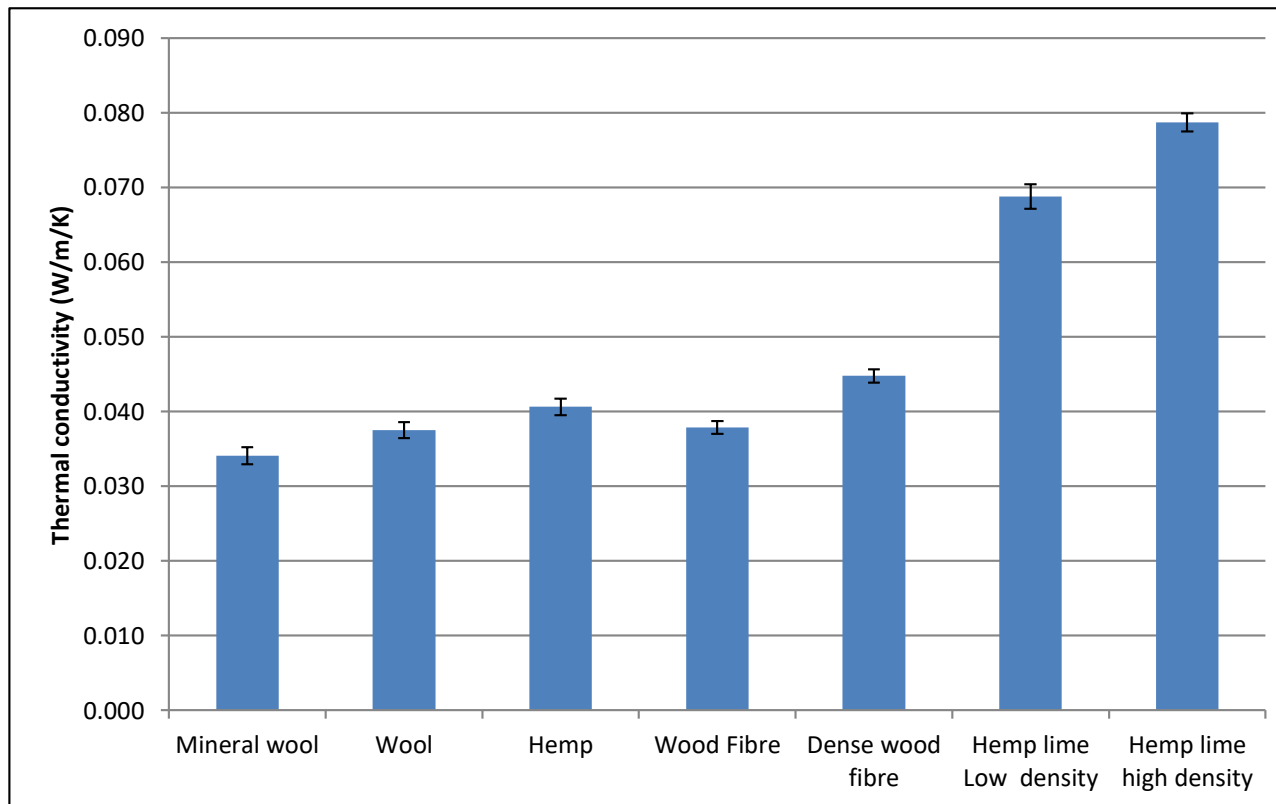
## Evaluation of insulation

- Determination of the thermal conductivity – k value
- Lower value = better insulator
- Measured using differently heated plates eg 0-20°C
  - Investigated effect of temperature range chosen

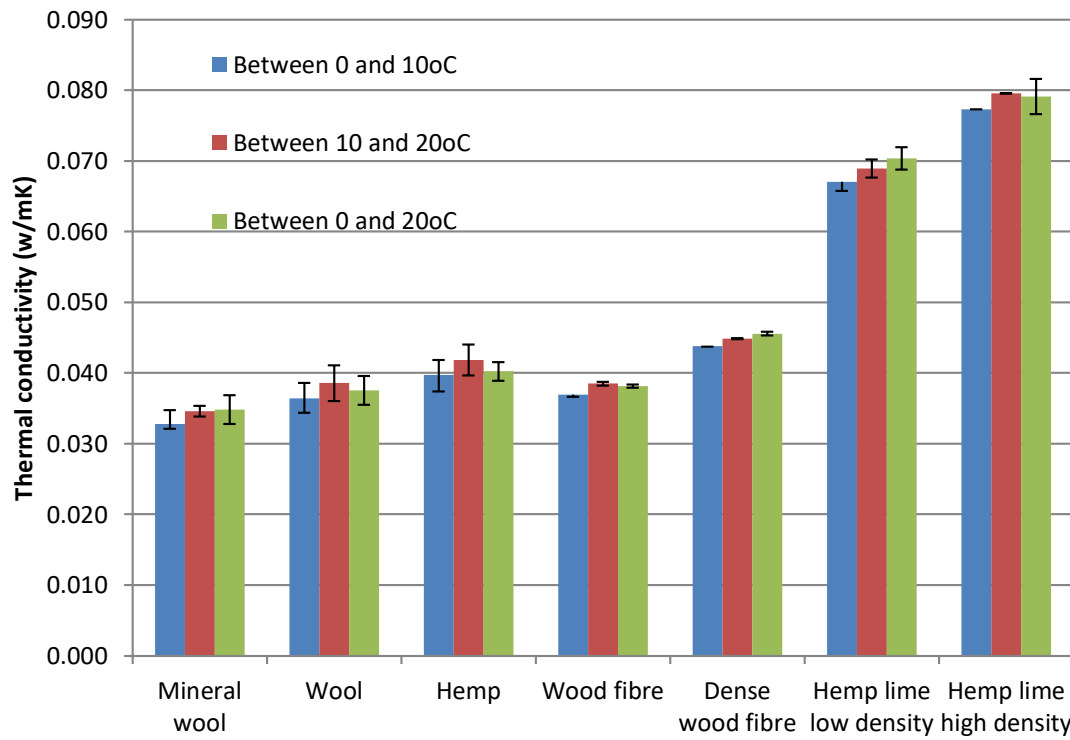




## Thermal conductivity of materials



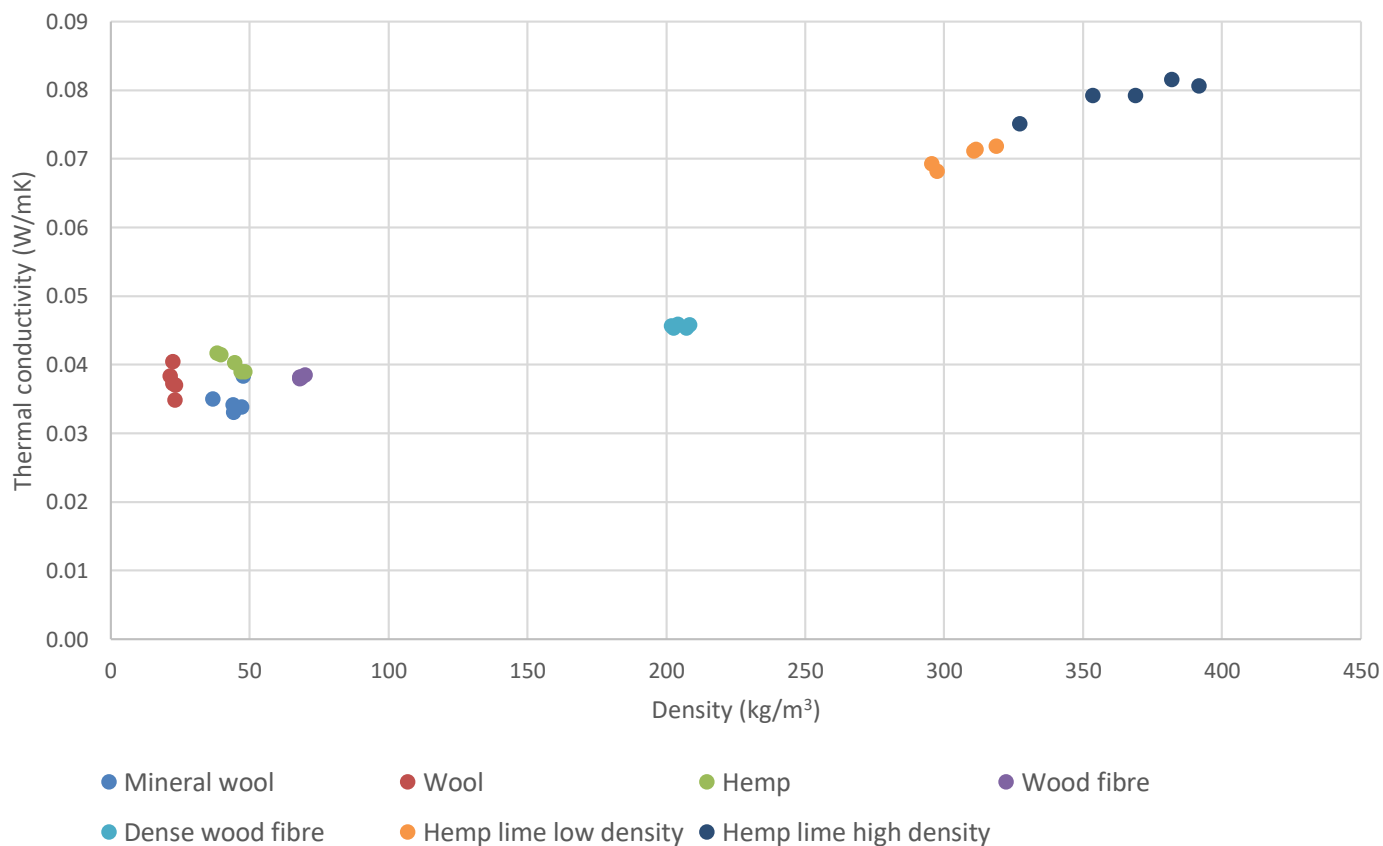
## Effect of testing temperature



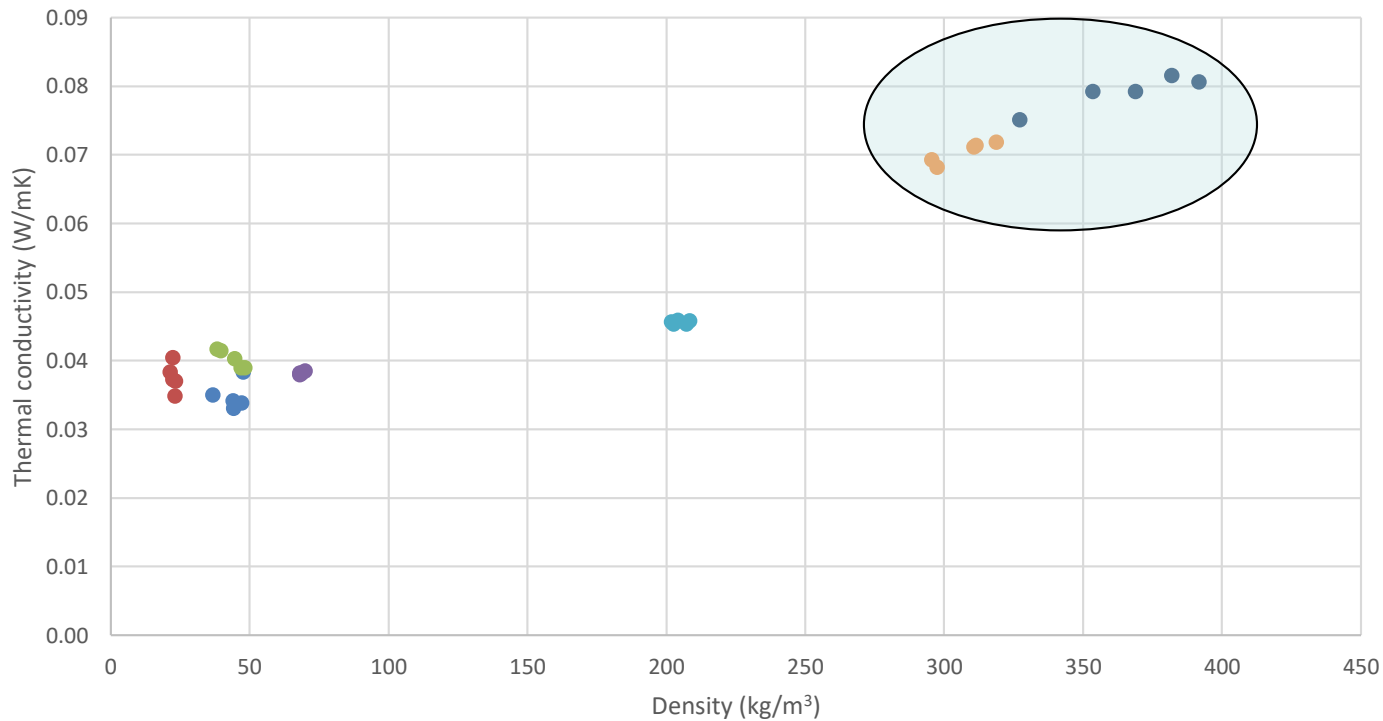
- Variation in testing temperature resulted in different k values
- Significant for wood fibre insulation but not other materials



## Effect of density



## Effect of density

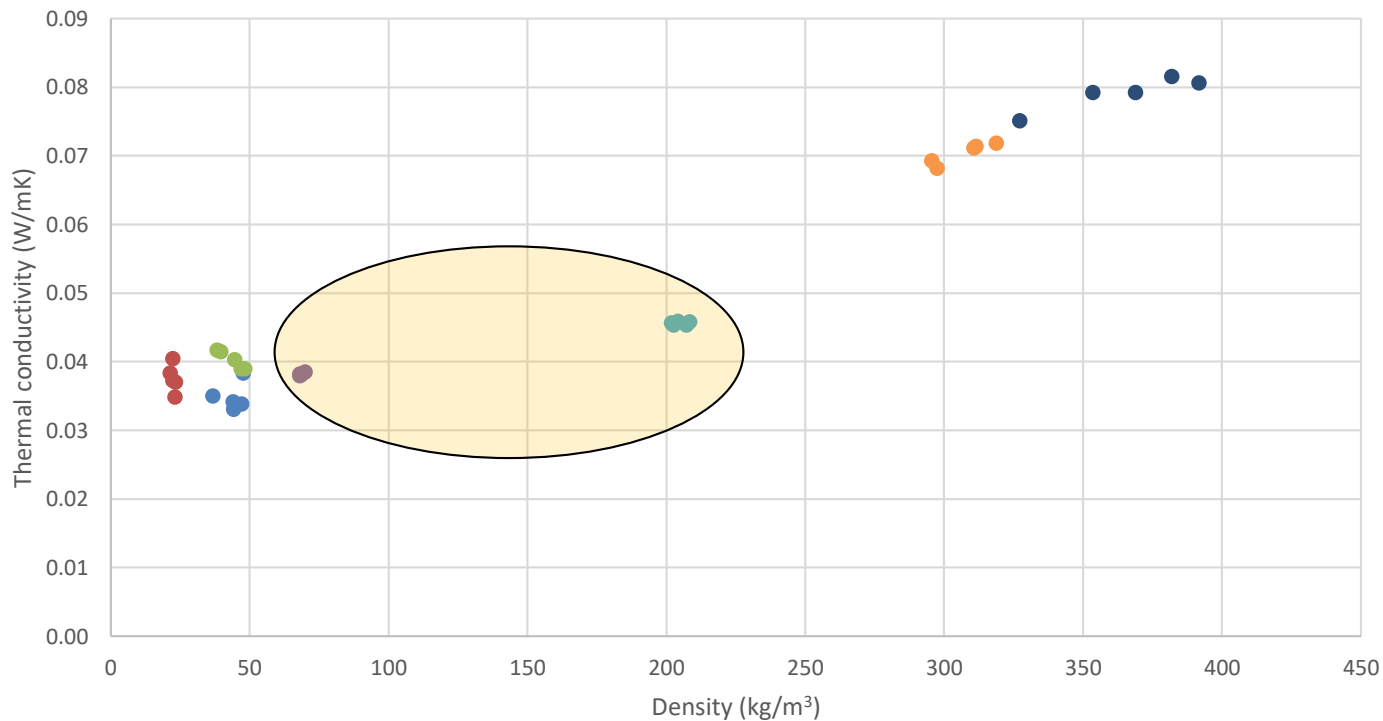


Hemp Lime –  
k increases as  
density  
increases



- Mineral wool
- Wool
- Hemp
- Wood fibre
- Dense wood fibre
- Hemp lime low density
- Hemp lime high density

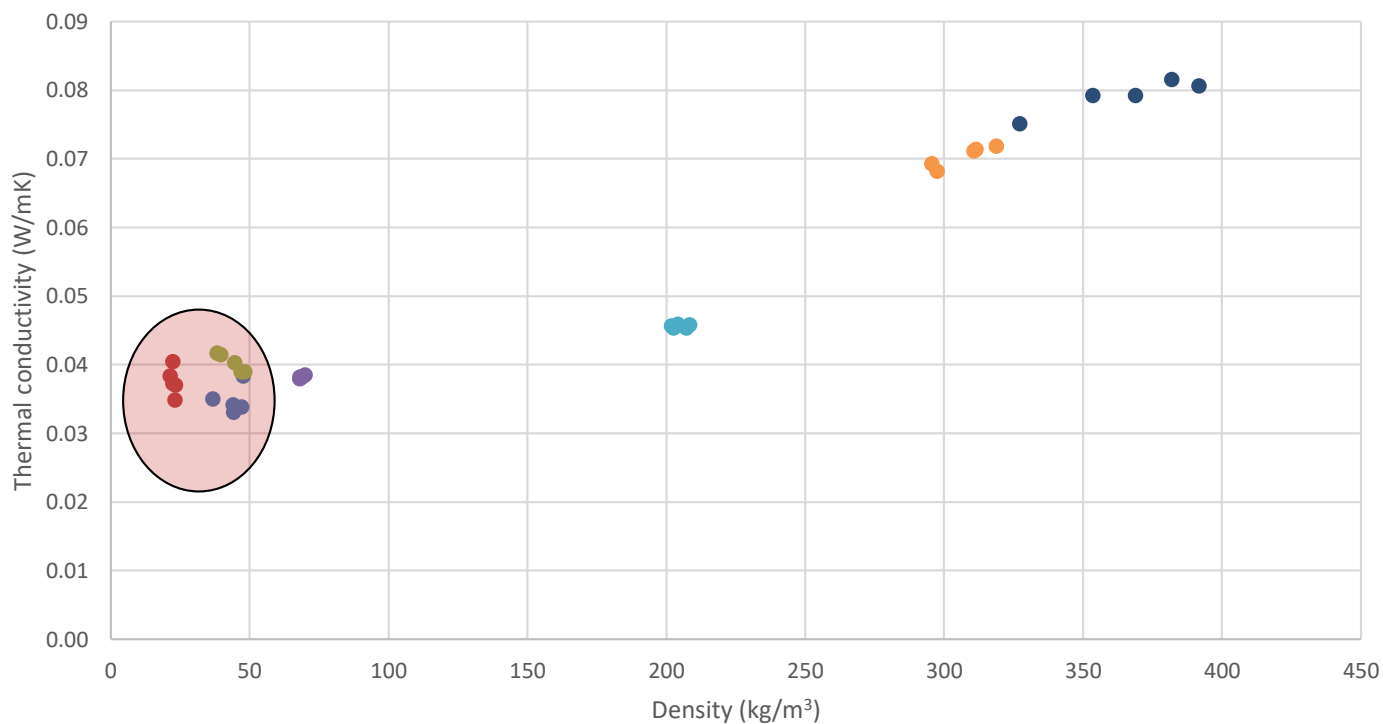
## Effect of density



Wood fibre insulation – k increases as density increases



# Effect of density

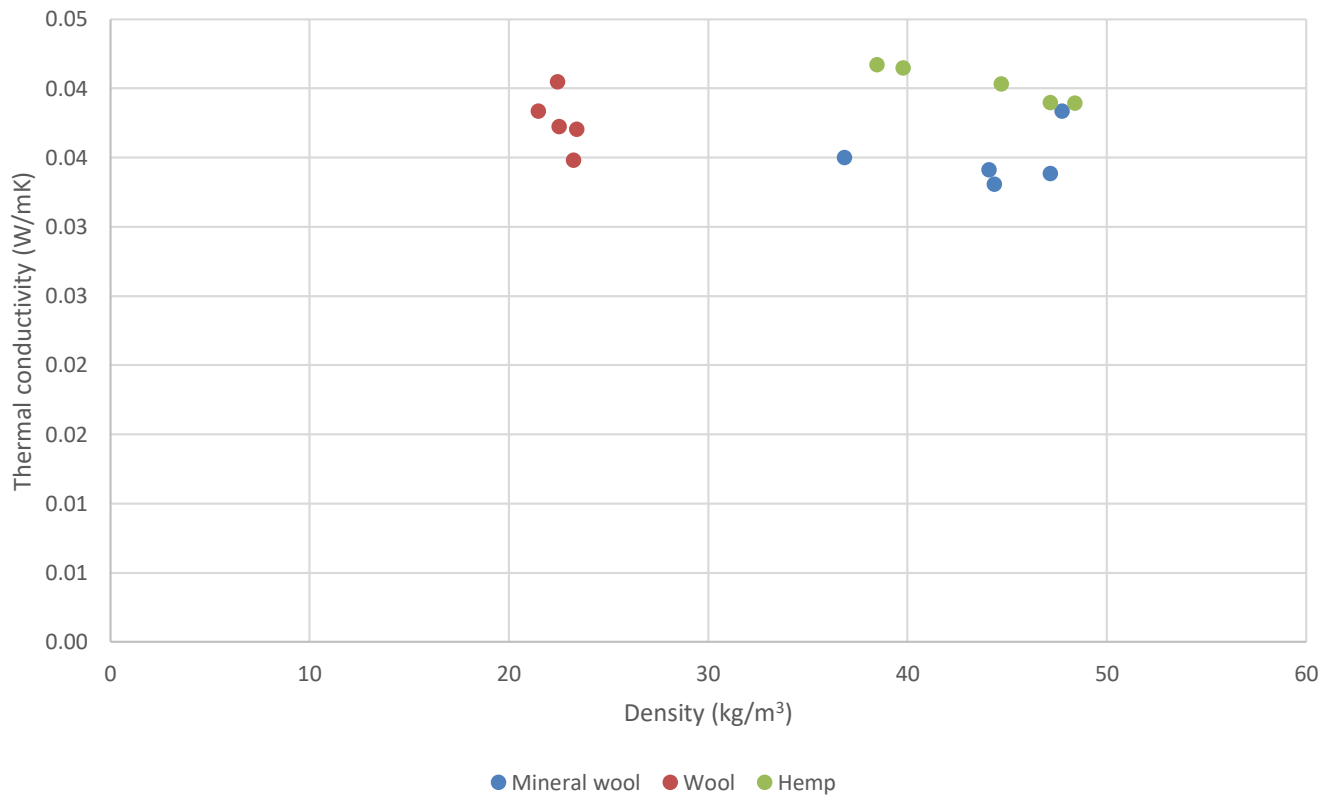


Fibre insulations



- Mineral wool
- Wool
- Hemp
- Wood fibre
- Dense wood fibre
- Hemp lime low density
- Hemp lime high density

# Effect of density on fibre insulation



k appears to decrease as density increases

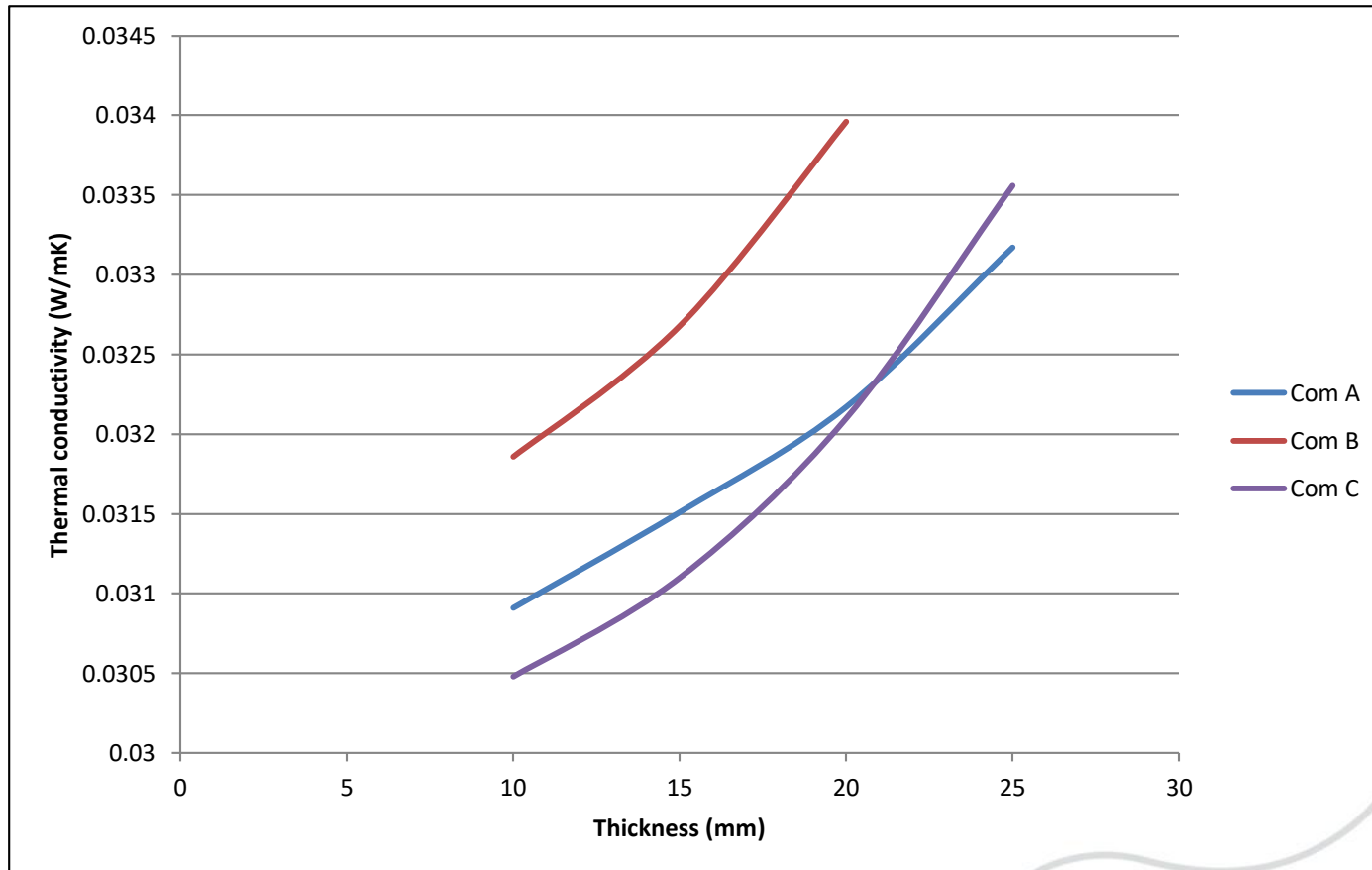


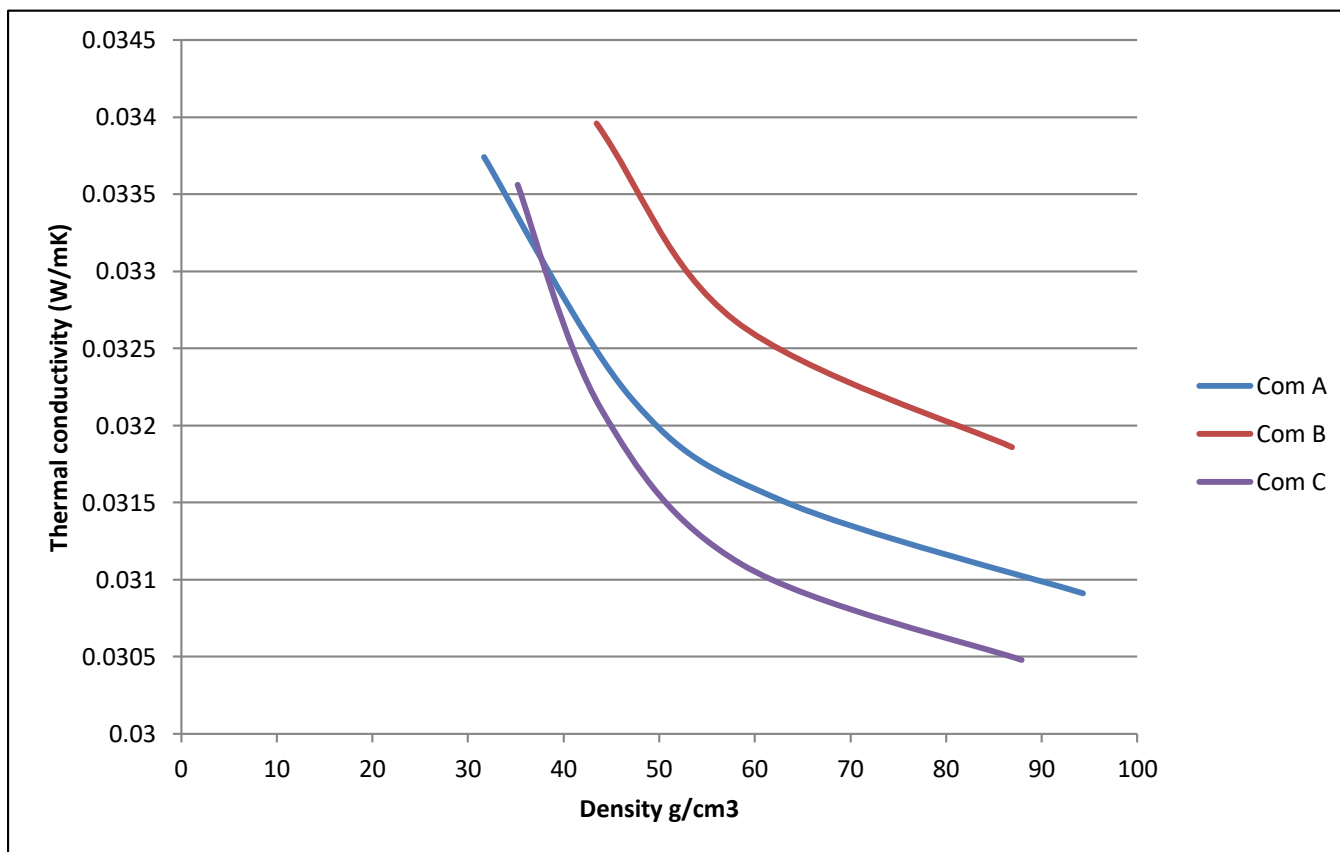
- How to increase density of fibre materials
  - Manufacture/weave of mat
  - Compress
    - If material is compressed does it affect the thermal conductance





## Effect of compression





## Effect of compression

- Compression of the wool insulation mats decreases the k values – better insulation
  - Good for panel construction
  - Possibilities for retro fitting



## Conclusion

- Thermal properties of insulation materials affected by the type and nature of the material
- Compression of fibre insulation, such as wool, decreases the thermal conductivity





## Acknowledgements



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 609234





Thank you for listening

- Any questions

