Bridging wood and cork in a new composite for construction: the case of reaction to fire

Sofia Knapic
Helena Pereira
José Saporiti Machado
∧ Stoppers
∧ Agglomerates
  with adhesives
pure agglomerates (black)
Expanded cork agglomerates
Black agglomerates
100% natural product

The granules are bound together without any extraneous adhesives

The adhesion results from the chemical degradation of extractives and the structural components of cork.

Agglomeration is carried out by an autoclave process carried out by superheated steam at around 300-350 °C and 40 kPa for approximately 20 minutes.
- Density from 105 to 130 kg m$^{-3}$
- Fire class: Euroclass E
- Thermal conductivity coefficient: 0.040 W m$^{-1}$ k$^{-1}$
- Acoustical absorption coefficient (for 500 Hz) of 0.33
- High durability under use conditions (chemical and biological inertia)
- Low water absorption
- High mechanical resistance under a wide range of temperatures
- Excellent dimensional stability
Expanded cork agglomerates → Suitable raw material for construction

 thermal insulation in roofs, walls, floors, and ceilings in private and public buildings

new treatment enhances its reaction to fire

wider range of construction utilizations and product development

**REASONING**
External cladding of the Portuguese pavilion in the World Exposition of Shanghai 2010
OBJECTIVES

- Improvement of the reaction to fire of the expanded cork agglomerate
- Development of a new composite incorporating solid wood
PROCEDURES

Expanded cork agglomerated boards: produced in an industrial environment and densified till 290 kg.m$^{-3}$

The samples were prepared according to standards, and treated with a non-dangerous inorganic chemical substance that does not contribute to the emission of VOCs and tested towards its fire performance.

*For reasons of patent development the exact type of product and treatment may not be displayed.*
√ Smoke production (%min)

√ Flame extinction (s)

√ Maximum extension of flame propagation (mm)

√ Critical flux (kWm$^{-2}$)

radiant flux at which the flame extinguished / the radiant flux after a test period of 30 minutes, whichever is the lower (i.e. the flux corresponding with the furthest extend of spread of flame).
<table>
<thead>
<tr>
<th>Planks</th>
<th>Critical flux (kWm⁻²)</th>
<th>Flame extinction (s)</th>
<th>Maximum extinction of flame</th>
<th>Smoke production (%.min)</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>untreated</td>
<td>5.36</td>
<td>756</td>
<td>390</td>
<td>50.05</td>
<td>Cₙ-s1</td>
</tr>
<tr>
<td>treated</td>
<td>7.72</td>
<td>1215</td>
<td>280</td>
<td>37.86</td>
<td></td>
</tr>
</tbody>
</table>

critical flux required to be class Bfl > 8.0 kW.m⁻²
OBJECTIVES

✓ Improvement of the reaction to fire of the expanded cork agglomerate

✓ Development of a new composite incorporating solid wood
APPLICATION: 3-layer flooring
**FINAL REMARKS**

- New treatment can be an effective option regarding the improvement of the behaviour of expanded agglomerated cork reaction to fire.

- A new expanded cork agglomerate with a higher tolerance to fire will enlarge the number of possible construction applications, enhancing the potential and value of cork agglomerates in construction.

- The combination of expanded cork agglomerate with solid wood in a new composite generate high-end products, adding commercial value to expanded cork agglomerate, and promoting new markets, alongside with the forest production diversification.
Thank you!

ACKNOWLEDGMENTS
Centro de Estudos Florestais is a research unit supported by the national funding of FCT – Fundação para a Ciência e a Tecnologia (UID/AGR/00239/2013). Funding from FCT is acknowledged by the first author with a post-doctoral grant (SFRH/BPD/76101/2011). This study was funded by FCT (Fundação para a Ciência e Tecnologia, Portugal) through the project EucPlus - New processes and uses for eucalypt woods (PTDC/AGR-CFL/119752/2010).