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Thermal conductivity of aerated coatings derived from natural agro-industrial by-products and recycled sheep wool

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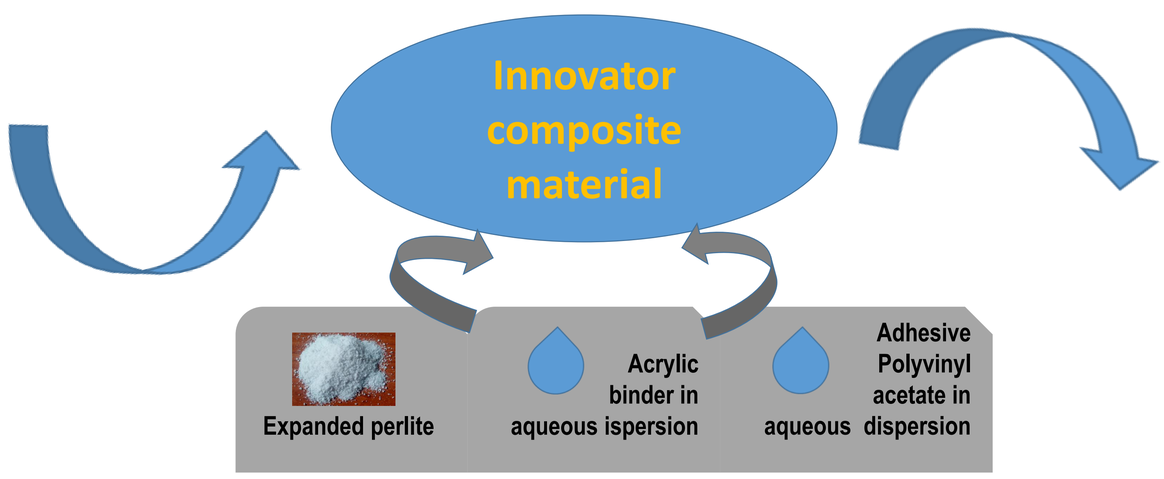
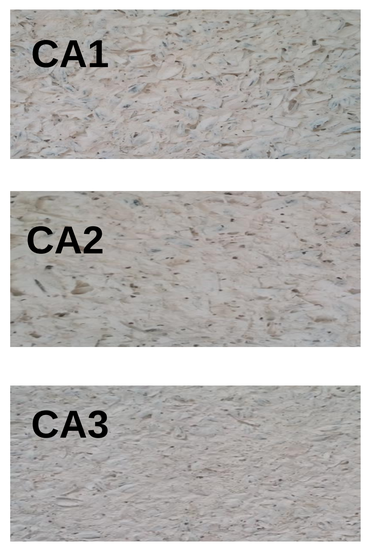
Context

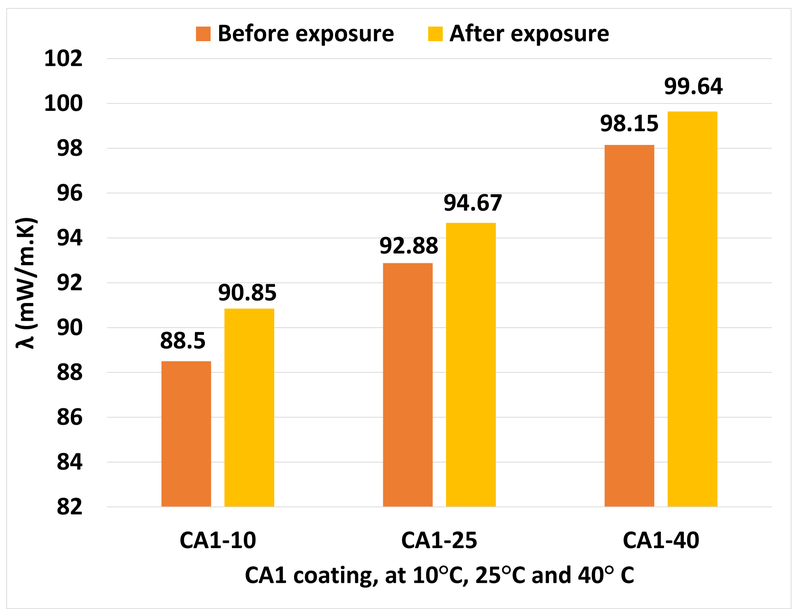
Starting from the principles and numerous advantages of the circular economy, the paper proposed and achieved the obtaining of several innovative coatings with aerated structures and heat-insulating characteristics, as well as monitoring their behavior under the action of an aggressive environment characterized by large temperature variations, simulated in accelerated laboratory conditions.

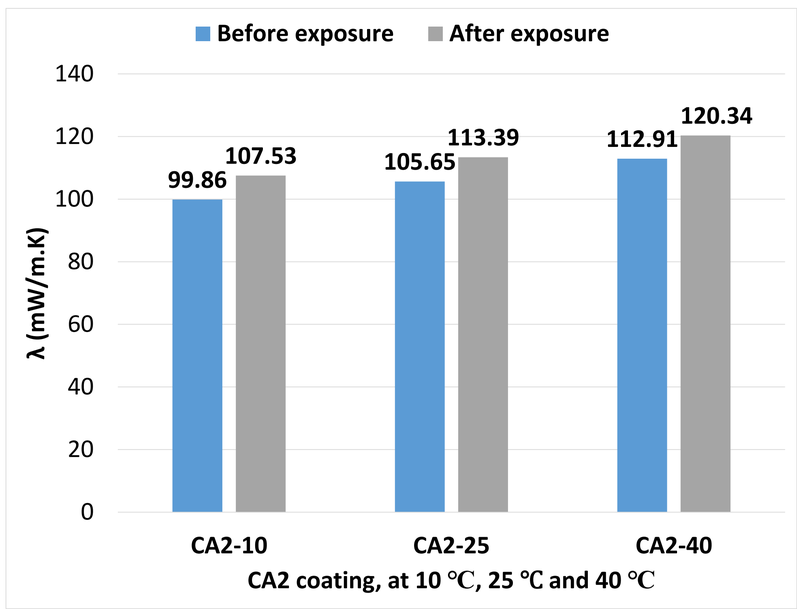
Materials and methods

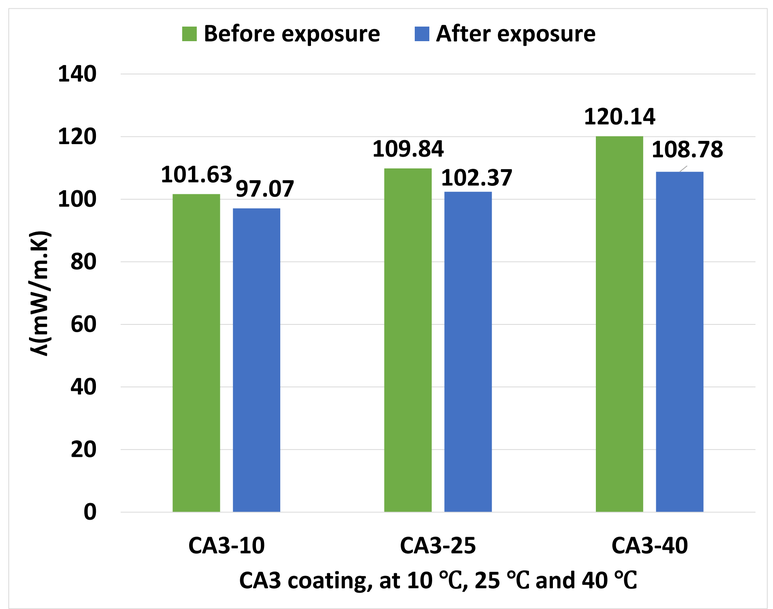
Three innovative coatings (CA1, CA2, CA3) were obtained. Each of them was made of a different biocomposite material consisting of 4 of the following components: acrylic binder, sunflower seed husk (agro-industrial by-product from the edible oil industry), recycled sheep wool (from a low quality mattress sheep wool), expanded perlite granules and a polyvinyl acetate adhesive in aqueous dispersion. Each biocomposite was applied to plasterboard surfaces. During the exposure to the aggressive environment, in cycles of 8 hours at (- 20)°C and 16 hours at (+23)°C, was studied the evolution of the thermal conductivity of the coatings, before and after 30 cycles of exposure, the determination being carried out at 10°C, 25°C and 40 °C.











Results and discutions

- The coatings AC1, AC2 and AC3 were characterized by thermal conductivities specific to materials with heat - insulating properties (in accordance with regulation C107/0-2002), although they had thicknesses of only 8.73 mm, 7.39 mm and 4.35 mm, respectively;
- Although they increased with the rise of the test temperatures, the thermal conductivities of the coatings remained within the characteristic limits for materials with heat-insulating properties.
- Coatings CA1 and CA3, having sunflower seed husks only of the highest dimensional fraction and high sheep wool waste content, had the best behavior under the action of large temperature variations.

Conclusions

Due to the compositions and aerated structures, all three coatings had thermal conductivities specific for the thermal protection materials, both before and after the exposure to the large temperature variations.

The CA1 and CA3 coatings had the best behavior, both as initial and final values of the thermal conductivities, regardless the test temperatures.

CA1, CA2, CA3 could be used in constructions as sustainable finishes with heat-insulating properties.

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