Technology Offer

TYRE4BUILDINS: Fibre-Reinforced Aerogel Composites From Mixed Silica

KEYWORDS: Aerogel; Composites; Rubber; Rubber-Silica; Silica and Rubeer Sols; Tyres.

One of the most critical issues in modern society is the constant increase of waste. Currently, over 1.6 billion new tires and around 1 billion of waste tires are generated worldwide every year. In the last decade, there has been a growth in the number of tires being discarded as end-of-life tires (ELTs), which leads to serious environmental problems. In order to improve the waste management practices, the European legislation has established a priority order for dealing with wastes, from the most preferred option of reduction, followed by reuse, recycling, energy production to least preferred option of disposal. However, significant difficulties are associated with the recovery and recycling of used tires, due to their composition and complex structure. The main component of the tires (70-80% of the total mass) is vulcanized rubber, and their disposal is an issue, as they are non-biodegradable and cannot be reprocessed in a simple process like the thermoplastics, remaining on the landfills.

Motivated by the environmental problems caused by ELTs, and the current potential markets for products obtained with recycled/reused materials, the goal of the present application is to disclose fibre-reinforced silica/rubber aerogel composites. The fibres imbedded in the aerogel matrix ensures its integrity while handling and improves the flexibility of the composite, as silica aerogels are inherently brittle and cannot be bent.

For the first time, recycled rubber sols were produced and incorporated in the silica sols. Since the ELTs rubber is vulcanized, it is very difficult to link its granules to other compounds in composites. Even when strategies are implemented to cross-link the rubber granules with other organic matrices or organically-modified inorganic matrices, these linkages are normally not strong enough and the granules easily separate from the composite.

The final aerogel composite materials herein disclosed were characterized regarding their chemical, physical, structural, and thermal/acoustic properties. Due to their very low thermal conductivity and bulk density, high vibration dissipation, hydrophobicity and good mechanical flexibility, these composite aerogels not only promote the recycling of waste tire, but also have a high potential for thermal and acoustic insulation applications (buildings, roads, automotive, aeronautics/aerospace, among others), as well as an adsorbent material for cleaning wastewaters with apolar pollutants (oils, organic solvents, pharmaceuticals, dyes, among others) by their sorption.

ADVANTAGES	APPLICATIONS
• Economic Circularity. • Rubber Waste reduction. • Recovery and Recycling used tires. • Low thermal conductivity. • High vibration dissipation. • Hydrophobicity, good mechanical flexibility. • High Sorption.	• Insulation: Buildings, roads, automotive, aeronautics and aerosapce. • Cleaning wastewaters: oils, organic solvents, pharmaceutics, dyes.

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A. Proof of concept - aerogel synthesis process with several waste materials (textiles in the top row; rubber - black samples; minerals in the bottom, on the right).
B. Rubber/silica aerogel.
C. Wall Insulation system.

VIDEO (QR Code or YouTube):

STAGE OF DEVELOPMENT: TRL 5
IPR LEGAL STATUS: Patent Pending n.° PCT/IB2022/050094.
OWNERSHIP: The rights to the technology are held by the University of Coimbra.
COLLABORATION SOUGHT: Market introduction & potential licensing for further developments or R&D partnership.

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