Polymer nanocomposites with high thermal, mechanical and electrical performance for structural applications in aeronautical and aerospace engineering.

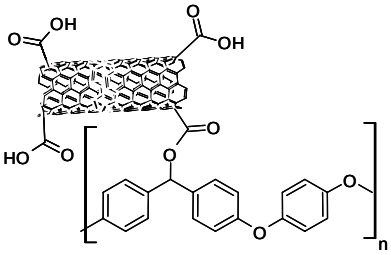
The CSIC has developed a polymer nanocomposite with thermal, mechanical and electrical properties drastically improved due to excellent filler dispersion in polymer matrix and to an optimal filler-matrix interface adhesion. The matrix is poly (ether ether ketone) (PEEK) or any polymer with similar structure. The filler is functionalized carbon nanomaterial covalently grafted to the surface of a polymer derived from the matrix. These nanocomposites are suitable for use in aerospace, aeronautical or transport industries, as well as for antistatic coatings and electrical shielding manufacturing.

An industrial Partner for a licensee agreement is sought

PEEK: a polymer with improved structural properties

In order to improve PEEK structural applications some attempts have been made to reinforce the matrix by means of adding nano-fillers. However, in many cases to achieve important improvements in mechanical properties about 10 wt% load concentration is required.

Recently the CSIC has developed a nanocomposite consisting in a polymer matrix and carbon nanomaterial covalently bound to PEEK derived polymer. Grafting PEEK derivate to carbon nanotubes (CNTs) surface enables good dispersion of them in the polymer matrix and improves interface adhesion between the two phases. Thermal stability of these materials is 10% higher than the matrix. The improvement achieved in the Young's modulus (E), tensile strength and toughness is exceptional. An increase of 58% in E is achieved with regard to the unreinforced matrix or 32% in comparison to the matrix reinforced with similar CNTs added by direct mixing. An improvement of 150% in thermal conductivity is achieved and electrical conductivity is increased by eight orders of magnitude.



Ideal for aerospace, aeronautic or transport applications.

Innovative aspects and advantages

- The production process of these nanocomposites is simple, effective and industrially scalable.
- Very good dispersion of the reinforcement in the polymer matrix and excellent interface adhesion between both phases.
- Low filler concentration is required to achieve nanocomposites with better mechanical, thermal and electrical properties than the unreinforced polymer or the polymer reinforced with similar fillers added by means of direct mixing.
- Different polymer matrices (PEEK or any polymer with similar structure) and also different carbon nanomaterial can be used (tubes, fibres, spirals, fullerenes or their combinations)
- Suitable for high-performance applications. In particular, for applications in aerospace, aeronautical or transport industries as well as for antistatic coatings and electrical shielding manufacturing.

Patent Status

PCT patent application filed.

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