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NEW COST-EFFECTIVE AND SUSTAINABLE POLYETHYLENE BASED CARBON FIBRES FOR VOLUME MARKET APPLICATIONS

The new frontier in the development, manufacturing and application of low cost carbon fibres

OBJECTIVES

The main objective of NEWSPEC is the development of CFs through promising low-cost polymers, such as polyethylene (PE). PE presents interesting technical features like high carbon yield (around 70%), high processability and flexibility (many potential polymer modifications to examine) and very competitive cost (~2 euro/kg) with respect to PAN precursor which may result to precursor cost savings of up to 70%. Final PE-CF production cost equals to 10 euro/kg compared to about 15 euro/kg of PAN fibres, thus reaching 30% cost saving on similar production scales.

EUROPEAN COMMISSION RESEARCH

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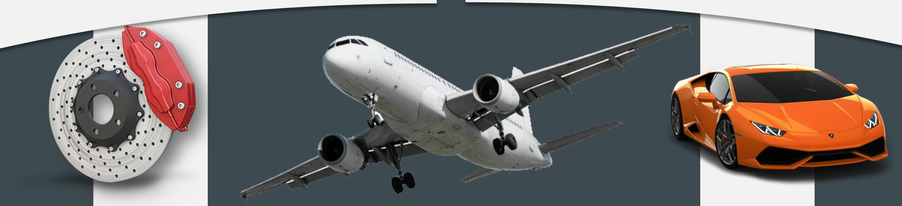

INNOVATION

- Propose a novel non-wet stabilization method that introduces heteroatoms at the precursor stage in combination with Electron Beam Curing (EBC) which makes the process very innovative, flexible, less time consuming and thus more economically viable.
- Exploit the potential of nanomaterials – carbon nanotubes (CNT) and cellulose nano wiskers (CNW) – as nucleation agents to further reduce the requested stabilization time and the graphitisation temperature. Lowering the graphitization temperature from 1500° to 1200°C can contribute to cost reduction of about 15- 20% with respect to typical PAN process. This will also contribute to overall cost saving.
- Innovative functionalization routes for the surface treatment of PE-based CF will be explored: (a) atmospheric plasma technology for controlled oxidation and grafting of other selected functional groups to the surface; (b) new methods of rapid room-temperature grafting on graphitic surfaces using specific surface attacking chemicals.
- Set-up of a transportable confocal micro Raman system which will be used on the processing line for monitoring the various steps of CF synthesis.
- Fundamental investigation and understanding of PE-CF/matrix interaction. Parameters such as Interfacial Shear Strength and the characteristic length scale (beta parameter) will be determined for various matrices and CF treatment and sizing.

END APPLICATIONS

AUTOMOTIVE
BRAKE ROTORS AND PADS

The use of carbon ceramics materials will revolutionize also the automobile brakes. In comparison to the conventional grey cast iron brake disk the carbon brake disk weighed round 50% less reducing the un-sprung mass by almost 20 kg. Further significant advantages are related with enhanced mechanical and thermal properties. Lower costs CFs will help ceramic brakes (CCM) to be deployed in mass market vehicles, especially where lightweight is a must like for instance electric cars.

AUTOMOTIVE
STRUCTURE, BODY AND INTERIORS

CF reinforced composites and plastics (CFRP) are increasing either for body or chassis components. Forged CFRP exhibit higher modulus and lower specific gravity relative to glass fibres as the modulus of commercial-grade CFs is more than four times higher than E-glass fibres. Less expensive PE-CFs for about 30% vs PAN can contribute to save up to 25% of costs thus opening perspectives for deployment of fibres into high-end segment cars.

AEROSPACE
LOW LOADED, SECONDARY AIRCRAFT STRUCTURES

Aerospace market for CFs composites is driven by the significant weight and performance advantages. B787 and A380 aircraft, over 250 tons jumbo jets, use CF composites in almost 50% of the aircraft in weight and 80% composite by volume.

WIND
TURBINE BLADES > 50M LONG. & RETROFIT OF MEDIUM TURBINES <35M LONG.

The increasing dimensions of wind turbines blades will require an extensive use of high strength fibres due to the enormous tensile loads on rotors with large diameters and heavier mass.

OIL AND GAS
PIPELINES, PRESSURE VESSELS FOR OIL/GAS COMPONENTS FOR HARSH ENVIRONMENTS

Pressure vessels, oil and gas pipelines are subjected to severe stresses and operate in harsh working conditions and environments, like maritime climate conditions. Low-cost CFRC can be used for strengthening and retrofitting of corrosion-damaged and distressed structures instead of glass fibres.

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