PLASTIC AND COMPOSITE TECHNOLOGY

GENERAL INFORMATION

The overall research objective is to create the scientific base at all length scales on which the next generation of materials, processing and designs for the fast-growing field of ***structural polymer and composite*** will be established. The activity is organized around five research domains:

1. ***Lightweight Design*** (Conceptual design and materials selection; Structural materials and structures; Multimaterials structures).
2. ***Structural Integrity*** (Energy absorbing and damage tolerant materials; Design for Impact; Design for fatigue; Tribology).
3. ***Advanced Processes of Composites*** (Out of Autoclave Technologies; Liquid Thermoplastic Processes; Fibre Metal Laminates; NDT for manufacturing).
4. ***Biopolymers for health*** (Bioabsorbable materials; Biocompatible materials for permanent prosthesis; Micro-nanotechnologies).
5. **Sustainability** (Recycling and Recovery; Natural fiber composites; Polymers from renewable sources).

Applications for automotive, civil engineering, machine-tool, home appliances and biomechanics have been developed.

ONGOING PROJECTS

1. LIGHTCARBONCARS: Automotive lightweighting by low cost carbon fiber composites.
2. CAFI: High fatigue and impact strength carbon fiber composites for automotive industry.
3. CRASHINT: Crashworthiness of themoplastic matrix smart composites.
4. AutoRTM: Thermoplastic RTM composites for automotive industry.
5. Design and manufacturing of scaffolds for tissue engineering based on biopolymer nanocomposites.
6. 3Rs: Composites from renewable polymer and reinforcements.

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RECENT PUBLICATIONS

1. The role of POSS on the thermo-mechanical properties of polyoxymethylene co-polymer based nanocomposites [J. Nanosci. Nanotech., acepted 18 Mars 2009].
2. Structure and mechanical properties of a talc filled PP/EPDM composite after re-processing in the melt state [J. Appl. Polym. Sci., 114 (2009) 1195].
3. Low-energy tensile-impact behavior of superelastic NiTi shape memory alloy wires [Mech. Mater., 41 (2009) 1050].
4. Constitutive model taking into account the strain rate for uniaxial NiTi SMA under low velocity impact conditions [Smart Mater. Struct., 17 (2008) doi:10.1088/0964 -1726/17/6/065033].
5. Effects of microstructure on wear behaviour of wood reinforced polypropylene composite [Wear 265 (2008) 606].
6. Iso-strain rate material behaviour curves applied to the finite element impact simulation [Polym. Testing 27 (2008) 84].
7. Electroactive pressure sensors for smart structures [Adv. Sci. Tech. 56 (2008) 122].
8. Comparison between the dynamical properties of polymer concrete and grey cast iron for machine tool applications [Mater. Design 28 (2007) 1461].
9. Novel all polymer microfluidic devices monolithically integrated within metallic electrodes for SDS-CGE of proteins [J. Micromech. Microeng. 17 (2007) 1289].
10. Effect of dissolution based recycling on the degradation and the mechanical properties of acrylonitrile-butadiene-styrene [Polym. Degr. Stab. 91 (2006) 2768].
11. Failure of multimaterial fusion bonding interface generated during over-injection molding/thermoforming hybrid process [J. App. Polymer Sci. 102 (2006) 261].
12. Characterisation of the impact behaviour of polymer thermoplastics [Polym. Testing 24 (2005)145].
13. Effects of injection moulding induced morphology on the fracture behaviour of virgin and recycled polypropylene [Polymer, 44 (2003) 6959].
14. Analysis of kinetic parameters of an urethane-acrylate resin for pultrusion process [J. Appl. Polym. Sci., 77 (2000) 355].

INFRASTRUCTURES

Materials characterization

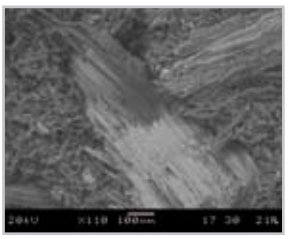
- **Mechanical testing:** Instrumented falling weight (4.6 m/s, 70 kg, 755J, -70÷150 °C) and pendulum impact test, Fatigue (100 kN, -120÷315 °C), Static tensile/bending/fracture (1÷400 kN) tests, Tribometre.
- **Microstructure:** Low vacuum SEM, C-SCAN phased array, High and low speed infrared cameras, DSC.

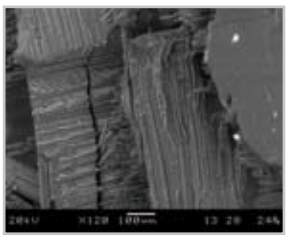
Processing equipment on lab scale

- **Plastic:** Electrospinning; Injection moulding (60 Tm), Mini-injection (maximum load 14 g), Thermoforming (400 x 400 mm^2).
- **Composite:** Thermosetting and thermoplastic RTM, Filament winding, Pultrusion, Stamp forming.

CAD/CAM/CAE

- ABAQUS STANDARD/EXPLICIT, COSMOS, PATRAN/NASTRAN, ESACOMP, MARC.
- CATIA, IDEAS, SOLIDWORKS, UNIGRAPHICS, CES-Edupack.





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