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Thermal and Dynamic Mechanical Analysis of phosphate glass fiber reinforced polyester composites

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Abstract

This work focused on the development composites materials based on phosphate glass fibers (PGF) . In this respect, Polyester matrices reinforced with short phosphate glass fibers (sPGF) up to 20 wt % were manufactured by the contact molding process. The Thermal and morphological properties of different sPGF-reinforced polyester systems were evaluated.

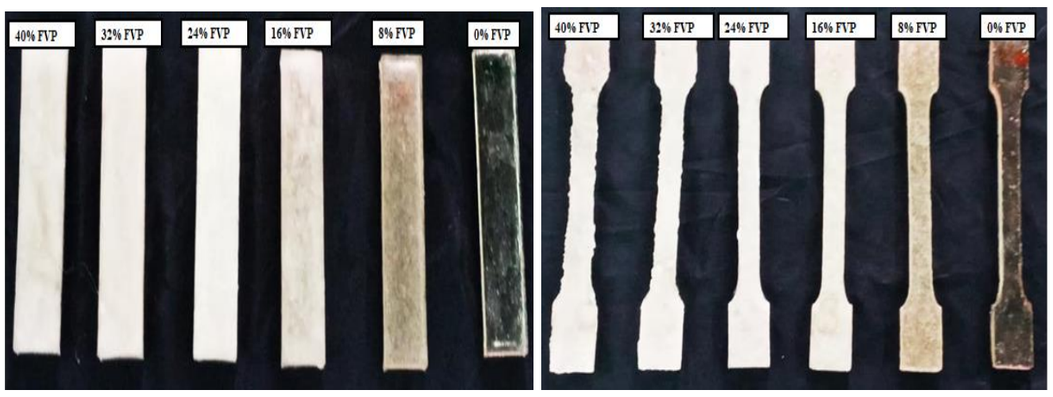
Methodology

phosphate glass fiber-reinforced polyester composites were prepared by the contact molding technique at a temperature of 25 ◦C. The fiber content varied from 8 to 32 vol %. In an open bowl, the polyester resin was thoroughly mixed with accelerator and a catalyst respectively. This prepared resin was mixed with phosphate glass fibers with length 3 ± 1 mm. Here, the mixtures were mechanically stirred, then poured into an aluminum mold prepared according to dimensions determined by ISO 527 and ISO 14125. The dynamic mechanical and morphological properties of different sPGF-reinforced polyester systems were evaluated.

Phosphate Glass Fibers

Éprouvettes préparés selon la normes ISO 527

Éprouvettes préparés selon la normes ISO 14125



Context

The worldwide consumption of composite materials, namely fiber-reinforced polymers, is increasing due to their high use in different sectors [1]. This wide use is due to their excellent insulating properties and high resistance to fatigue and corrosion [2]. Currently, the main fibers used to manufacture organic matrix composites consist of glass fibers (GF) and Phosphate glass fibers (PGF)[3].

Result

The study of the thermal-mechanical DMA (fig.1)and Morphological (fig.2) properties of the elaborated composites materials shows. The value of storage modulus and loss modulus of the composites increased with increase in fibre loading from 8% to 32% and decreased with increase in temperature. This means that the movement of the polymeric chain of the polyester resin is limited and the increase in internal friction of the composites which promotes energy dissipation. The Morphological analysis show that the composites developed offer good interfacial adhesion

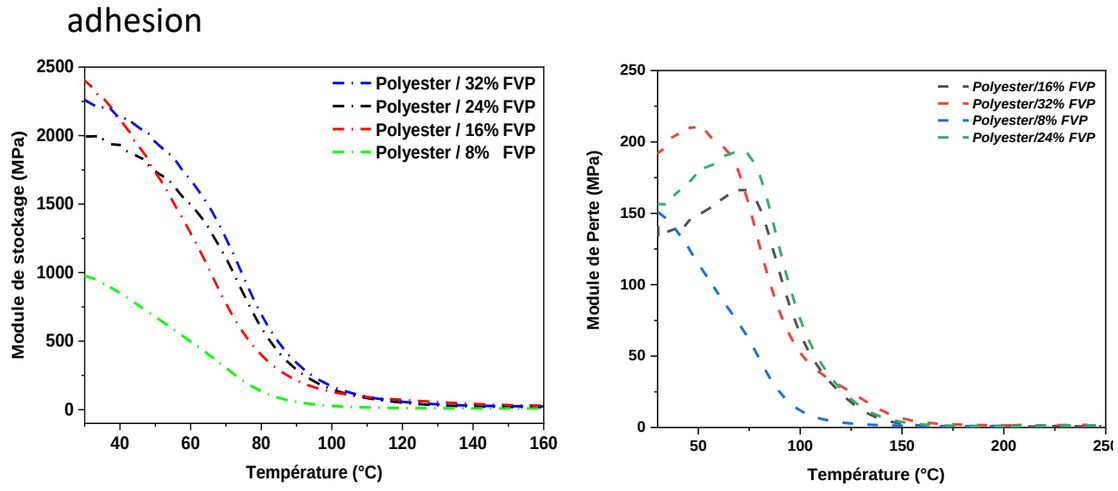


Fig. 1: Thermal-mechanical properties of composites materials

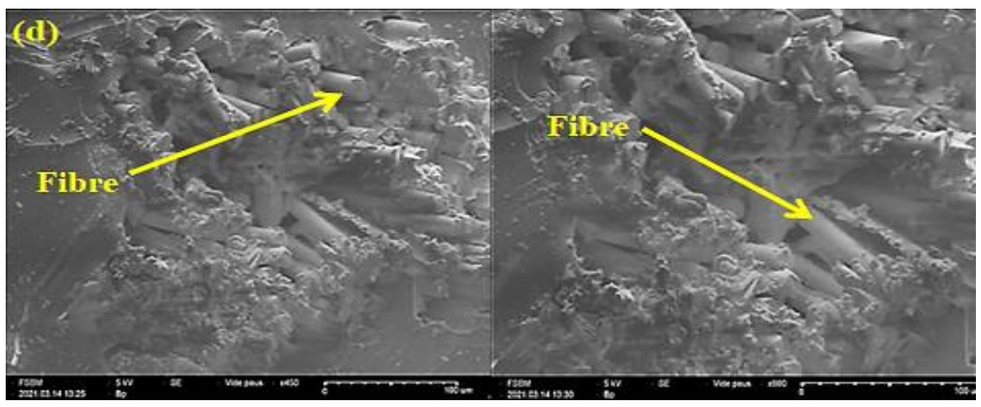


Fig.2: Morphology of polyester composites reinforced with 32vol % of PGF

Table 1: Tensile properties of composite materials

Samples	Fibre content (%)	Tensile strength (Mpa)	Tensile modulus (GPa)
Polyester /Phosphate glass Fibers	0	11	0,92
	8	14,5	1,1
	16	22,41	1,42
	24	30	1,62
	32	38,12	1,8

Conclusion and perspectives

The results obtained show that the developed composites provide good interfacial adhesion. The study of mechanical properties shows that the tensile strength of the developed composites was increased from 11 to 38.12 MPa with the increase of fiber loading in the composites from 8% to 32 vol%. The thermal-mechanical properties were also improved.

References

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