11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM 2009

# The Use of Polyester/Glass Fiber Residues as Fillers for Composites

L. S. Vasconcelos(1)*, C. C. Angrizani(2), J. R. Souza(1), S. C. Amico(2), J. T. N. Medeiros(1)

(1) Departamento de Materiais, Universidade Federal do Rio Grande do Norte, e-mail: laisvasc@gmail.com
(2) Departamento de Materiais, Universidade Federal do Rio Grande do Sul, e-mail: cangrizani@hotmail.com, amico@ufrgs.br
* Corresponding author.

**Abstract** – In this work, the performance of polyester/glass fiber composites was studied in order to promote the use of polyester/glass fiber residues. The composites were produced using either composite residues, obtained via knife or ball milling, or calcium carbonate as fillers. Composites with up to 50% (weight fraction) of reinforcement were prepared by hot compression molding and characterized via physical (density and water sorption), thermal (thermogravimetry) and mechanical testing (impact, Barcol hardness and tensile). Tribological tests were also carried out. The findings suggest that polyester/glass fiber composite residues may be used as partial substitutes for calcium carbonate, usual commercial filler.

The ever-growing use of synthetic fiber polymer composites has become an environmental concern since their residues (mainly glass fiber) can not be readily recycled. Some research works and techniques have been developed aiming to reduce the amount of residues such as incineration, chemical degradation and mechanical grinding, as in [1]. In this work, polyester/glass fiber composite residues were used after mechanical grinding and incorporated into virgin polyester/glass fiber composites. A ball mill and a knife mill were used for comparison and two different granulometries were tried, 16 and 60 mesh. The composites were hot compression molded and the following formulations were used: control composites (polyester/glass fibers, polyester/$CaCO_3$ and polyester/residues) and two tri-component composites, polyester/glass fiber/$CaCO_3$ (50/35/15, 50/25/25 and 50/15/35, weight basis) and polyester/glass fiber/residues (50/35/15, 50/25/25 and 50/15/35, weight basis). The produced composites were characterized via different techniques, including density, water sorption, thermogravimetry and mechanical (impact, Barcol hardness and tensile) and tribological tests, following ASTM standards.

Figures 1(a) and 1(b) show the residues obtained after grinding and it may be easily identified, especially in the coarser material, the fibers and the resin particles. Figures 1(c) and 1(d) show some of the produced composites. Table 1 shows density, hardness and impact strength results of the polyester/residue composites. The 60-mesh composites produced higher density (i.e. lower void content) than the 16-mesh ones probably due to a better compaction of the finer particles. However, that did not translate into better impact strength of the composite probably due to the lower length of the fibers in the former.

Regarding the milling method, the ball mill was chosen as the preferred method based on the lower scatter found in the results. Therefore, the tri-component composites were produced using only 16-mesh residues ground in a ball mill. The findings suggest that the residues may be considered an alternative for the partial substitution of calcium carbonate, a common filler for polyester/glass fiber composites used for a variety of applications.

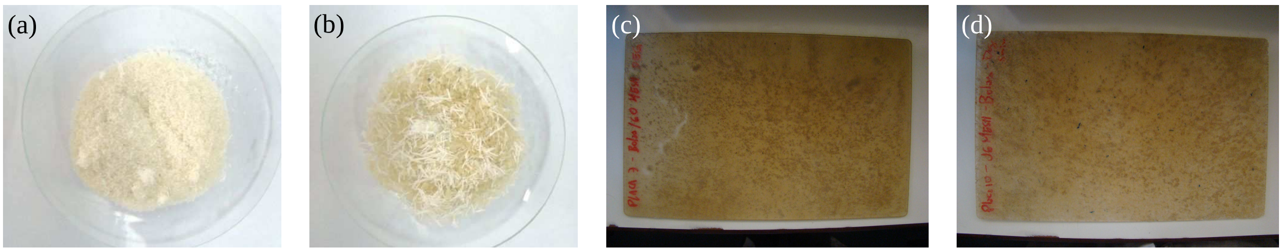


Figure1. Residues ground by ball milling using 60 (a) and 16 mesh (b), and polyester/residue composites produced with them (c and d, respectively).

Table 1: Density, hardness and impact strength of polyester/residue composites.

| | Mesh | Density (g/cm$^3$) | Barcol Hardness | Impact strength (kJ/m$^2$) |
|---|---|---|---|---|
| Ball mill | 16 | 1,185 (± 0,002) | 42 (± 2) | 45,1 (± 9,8) |
| | 60 | 1,196 (± 0,004) | 42 (± 2) | 15,8 (± 4,8) |
| Knife mill | 16 | 1,185 (± 0,002) | 44 (± 2) | 42,2 (± 18,4) |
| | 60 | 1,192 (± 0,013) | 45 (± 2) | 24,0 (± 7,7) |

## References

[1] E. M. Araújo, K. D. Araújo, O. D. Pereira, P. C. Ribeiro; T. J. A. de Melo, Polímeros: Ciência e Tecnol. 16 (2006), 332-335.