

USE OF RECYCLED IN THERMOPLASTIC MATRIX COMPOSITES REINFORCED MATERIALS IN MARINE ENVIRONMENT: CHARACTERIZATION AND PROCESSING.

A.V. MARTÍNEZ SANZ, J. LÓPEZ MARTÍNEZ, S. FERRÁNDIZ BOU,
V. ROMERO COLOMER.

Polytechnic University of Valencia, Ferrándiz Carbonell square, s / n, 03801 Alcoy, Spain
anmarsan@mcm.upv.es, sferrand@mcm.upv.es

Keywords: composites, thermoplastics, marine vessel building

Abstract: The use of thermoset matrix composite materials has been common in marine environments. But over time, these usually made from polyester matrices suffer a substantial decline. Thermoplastic matrix does not exhibit this problem, especially when use polyolefin, but nevertheless they are more susceptible to long-term efforts. The use of metal tube based reinforcements can be an interesting alternative for this kind of environment, and in this work has begun studies to determine the industrial feasibility of the process. The experimental procedure for characterization of the matrices included the following recyclable polymers supplied in the form of pellets: ABS, polypropylene and high impact polystyrene selected for their usual supply potential and low recovery of the waste. The metallic hollow tube reinforcement used is the most common of those used in the automotive industry (E220). In the samples has been made a thermal, mechanical and rheological characterization in order to establish a comparison of effective selection. To accomplish the process has been used scanning electron microscopy (SEM) for microstructure visualization and analysis of the structures degraded characteristics by sea action and new structures made of FRP.

1. INTRODUCTION.

The composite piles were used for the first time in the late 80s as a replacement of timber piles in the Port of Los Angeles (USA). The first prototype of composite pile was driven in 1987 and consisted in a tube made of recycled plastic coated steel [1,2].

There are several types of compounds piles:

1. Piles with steel core tube (a)
2. Structurally reinforced plastic matrix piles (b)
3. FRP pipe piles filled with concrete (c)
4. Pultruded fiberglass piles
5. Plastic timber piles.

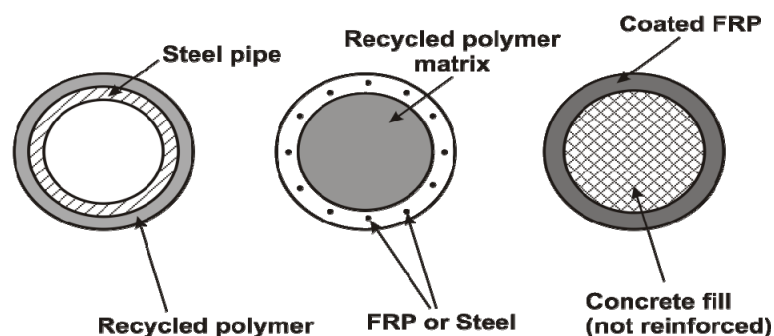


Fig 1. : Schema of Structural Sections

The first three types of piles are considered the best for loading applications and Figure 1 shows a schema of how would be structurally [5].

The use of fiber-reinforced polymers in construction technology has allowed the development of more efficient structures with low weight, high corrosion resistance and the

ability to control their mechanical properties[3]. These materials may have got a performance profile than conventional materials such as steel, wood or concrete.

Some applications of composite piles are:

1. Framework defense in marine environments,
 2. Foundation structures for lightweight structures, or in many cases, research subjects in universities laboratories.
 3. Currently are analyzing the use of steel tubes with TeroCore ® structural foam [4] filling for the construction of bus structures. It enables to use smaller pipe thickness and thus reduce vehicle weight. The foam purpose is to prevent the collapse of the tube walls.
- The most important functions of PRF coating are providing a kind of scaffolding during casting. It confines the concrete fill and serves as reinforcement to the pile front tensile stress and degradation concrete.

Therefore, this research studies the possibility of use thermoplastic polymers. Particularly study polymer recycled in order to provide added value. The goal is obtain a composite in which the matrix is a thermoplastic polymer recycled and reinforcing is steel tubes. Don't rule out the use of structural foam inside steel tubes to avoid the collapse of steel tubes in certain applications.

2. EXPERIMENTAL

We study the materials those are object of interest by partner companies:

- Röchling: Samples of recycled in the form of pellets:

ABS computers, ABS alarms, Polypropylene PP1B, Polypropylene PP1T, High Impact Polystyrene (HIPS)

- Flinsa: hollow metal tubes of different diameters and grades according to the company's manufacturing. Only has been used for this study the E220 type.

The number of beams reinforcement per panel varies between 1 and 5 units outside diameter being less than 100 mm.

The goals to be obtained are:

- Design and analysis of a sheet plate of thermoplastic matrix composite material for his introduction into the shipbuilding industry with specific dimensions. They have introduced a series of hollow tubes of steel reinforcement with the ultimate goal of reducing the density of the material used in the matrix.

- The design and analysis has determined the size of the plate, the number of tubes used and the diameter of these. Calculations have been carried out in order to determine what values get a greater decrease in the iron density.

- It used recycled thermoplastic materials to provide added value. We might get a composite in which the matrix is a thermoplastic polymer and reinforcing steel tubes are different qualities of the partner company. It has used structural foam, inside steel tubes, to avoid the collapse of the tubes in some applications.

The polymer characterizations have been carried out on recycled polymers like ABS (computer origin), ABS (alarms origin), HIPS, PP1b, PP1T.



Fig 2. Recycled polymers samples analyzed: PP1B, PP1T, ABS alarms, Computer ABS, HIPS.

