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## RECYCLING OF COMPOSITE MATERIALS. APPLICATION TO THE CAR INDUSTRY

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### Abstract

A pressing problem, in developed countries is the recycling of vehicles, particularly cars and trucks. In general, there are three types of vehicles for recycling:

1. The old models, not designed for recycling. They are metallic mostly. Different components, fed up recycling metal and other materials recycling, is scheduled separated in a way If the vehicle is already planning for a smart recycling there are two choices:
2. Vehicles designed for recycling with metallic body
3. Recyclable vehicles finally containing high percentage of non-metallic materials, as composites. The problematic in recycling of is included in this contribution, in special new process for composite recycling.

**Keywords:** *Car, composite, metallic, industrial process*

### INTRODUCTION: METHODS FOR THE RECYCLING A CAR

The process should be automatic in all cases. First step is recover pieces for use as a cheap spares. Second is separate from the vehicle structure, wheels, brakes, engine, and any other element. The rest is disposable material

In the case of metallic vehicle, this structure is the removal of the seats, mirrors and any other element, and goes directly to be pressing for scrapping and recovery of metal by the usual procedures. Each type of material takes a different recycling other procedures.

Finally, in the case of predominantly non-metallic vehicle recycling is done different, treating specific non-reusable components as spares, on an individual basis according to their

characteristics. We are interested in composite, because its are materials to increase their participation in future lightweight structures for cars in the next generation.

### RECYCLING TECHNIQUES FOR COMPOSITES

The techniques of recycling these materials are based on plastic recycling.

From the standpoint of manufacturing composite materials for self-reinforced type, which are used in the automotive field, can be processed with relatively low pressures and temperatures, allowing energy savings and reducing investment costs in molds and processing equipment.

This material is easy to handle, does not produce skin irritation typical of working with fibreglass. Also worth remembering that during processing, the life of the molds increases due to low pressures and lack of abrasion.

This semi-prepared material is preheated to 150-170 ° C and then processed through "matched tools" in a low-pressure press or through a mold of a face with a bag of rubber and compressed air. Whatever the method used, you can get HD without narrowing or weakening the walls of the casting. Moreover, the thermoforming temperatures are needed to laminate other materials directly into a single pressing.

All materials can be recycled in more or less difficulty. Regarding the composites, pure polymers are easier to recycle. However, the recyclability can not always prevail before the mechanical properties.

The self-reinforced thermoplastics are in effect the bridge between isotropic polymers and fiber reinforced composites, combining lightness and good mechanical properties with the possibility of recycling through existing technologies.

When considering the total life cycle of a product, self-reinforced thermoplastics are clearly more environmentally friendly than other composites such as GMT and NMT2. Given the manufacture of raw materials, semi-prepared material, the transformation into pieces, the weight of the finished product apart from the opportunities resulting from recycling, it is quite clear that the materials self-reinforced PP has advantages over traditional fiber reinforced composites, even from an environmental standpoint.

The recycling of thermoset composites can start by crushing and grinding of the disassembled parts in order to obtain separate dust and fibers. The powders can be incorporated into the production process again as fillers, while the fibers may find application in the reinforcement of concrete, asphalt, etc.

The composite materials of thermoplastic nature pose fewer problems for your good recycling. Its present ability to be repaired by different procedures for reuse later, as spares.

The thermoplastics can be welded or use adhesives allow adequate, while thermosets must be remedied by the application of resins and reinforcing fiber blankets, or reinforced polyester putties. Thus, car repair shops, they have become in the near future, true technology centers, with highly qualified professionals and cutting edge equipment to meet the demands imposed by new materials and technologies that incorporate the cars and every time be more complex

## RECYCLING PLANT

The scheme for recycling cars, is a profitable activity, is the creation of recycling plants where industrial type vehicles arrive (Figure 1).

At the same, according to the schemes described above, first comes the selection of reusable components as spares.

Then it would proceed to scrapping, separating metal parts, seats, plastic components and other materials. This type of activity, also has its environmental plan, to avoid harmful emissions and waste gas. The elements that are obtained are transferred to different industries for final manufacturing.

In the particular case recycling of composites, the parts come in and go to parts

repaired, while the pieces have been pressed and go to the plants producing.

The fibers for recycling, reinforcing materials will be used for highway reparations.

Metallic materials, which are currently the largest percentage of recycling of motor vehicles to be properly prepared for furnaces.

Other materials(glass, seats, etc.) are going to specialized industries.

## IMPORTS OF RECYCLING

With a shortage of raw materials, recycling becomes extremely important industrial and environmental.

Spain is in first position on the European market in regard to recycling of-life vehicles, as currently recovers 90% of vehicles at the end of its useful life, while the European average stands at 85%, according to a joint study by the Spanish Association of Environmental Management-life vehicles (Sigrauto) [1] and the Spanish Federation of Recovery (FER) [3], which collects FACONAUTO [2].

The recycling of composites is very small yet, but we must be prepared to address them in future.

## DIFFERENT RECYCLED PRODUCTS FROM VEHICLES

Main Element from vehicle recycling, is today the metal casting. It get up to 70% of metal of the vehicle that passes due to a pressing furnace. Tires that are used to build solar mixtures for roads. 100% recycled

Components used as spare parts for used cars. This industry is becoming more prosperous. It use a 75% of the disassembled vehicle before scrapping of the car body.

In the case of composite recycling is based on two components: The composite itself is turned into powder and sent to a factory of composite materials, fibers and recycled domestic cement highway, like tires. It is also possible to recycle properly prepared complete pieces that go to the manufacturer or its dealers



**Figure 1.** Plant materials sorting and recycling of composite materials in car

## REFERENCES

- [1] SIGRAUTO. Composites Recycling Guidelines
- [2] FACONAUTO. Composites in car
- [3] FER. New materials in the car