Reduction in the Fuel Consumption of Car by Polypropylene Compound

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***Abstract*—Continues Increase in the fuel rates has created big problem for transportation all over the world. In such condition it is very necessary to get over the problem by some innovative techniques. In this paper we have tried to implement some innovative techniques which can reduce the consumption of fuel of car. In this study we have tried to reduced the fuel consumption in car upto 10% with the help of polypropylene compound. We have also increased the flexural strength of car by adding inorganic compounds in PP. Some problems and solutions for injection molding are also summarized. This paper deals with the light weight and great mechanical strength of polypropylene fibre which helps in reduction in the fuel consumption of car.**

***Index Term*— polypropylene compound, mechanical strength, fuel consumption, flexural strength.**

I. Introduction

The fuel consumption depends much upon the weight of the car. The fuel consumption can be reduced by decrease in the weight of car. Bt also the risk of substitute fibre that is used should fulfill all the needs. Hence we have tried to overcome such problems by using PP. Polypropylene(PP) is low in cost but has outstanding mechanical properties and moldability, it accounts for more than half of all the plastic materials used in automobiles. Polypropylene compounds can be used for a variety of parts, including bumper facias, instrumental panels and door trims. Fig. 1 shows a general constitution of PP compounds for automotive applications. The impact strength of the ―impact PP, which is composed of homo PP and ethylene propylene copolymer (EP copolymer), is improved by adding an ethylene-based elastomer such as ethylene-butene or ethylene-octene copolymer, to which inorganic filler such as talcum is added for enhanced rigidity. With respect to resin-based automotive parts, lower weight is demanded for the sake of reduced environmental burden and better design and higher moldability are also required. In response to that demand, various phases of PP compounds for automotive applications have been improved. The improvements made thus far include greater rigidity, impact strength, fluidity and crystallization. Such enhancements of PP compounds have been achieved by compounding PP with additives such as elastomers and/or various inorganic fillers, as well as through higher stereoregularity, fluidity and rubberization which have been achieved with the aforementioned improvements in catalysts and the manufacturing process. The growth of PP compounds for automotive applications has thus far been supported by the improved performance of PP resins—which serve as the base of PP compounds—and advancements in compound technology. With respect to the former, catalysts and the polymerization process have been continually, energetically improved in order to control the primary and higher order structures of polymers. Regarding the latter, improvements in the performance and dispersibility of elastomers, as well as the control of particle size, dispersion and interface of inorganic fillers, have been attempted up to the present time. With respect to resin-based automotive parts, lower weight is demanded for the sake of reduced environmental burden and better design and higher moldability are also required. Also with the use of the filler materials the strength of the material made of polypropylene fibre has been improved. Also the property of polypropylene compound of fire resistant as the ignition temperature of the PP is very high. And the flexural strength is excellent, hence it is best replacement for metals and plastic for the car parts.

II. Improving Impact Resistance

The impact PP containing EP copolymer is used for PP compounds in automotive applications. It is observed that the glass-transition temperature shows the minimum value when the ethylene content is approximately 60 wt%, and the performance as an impact modifier is good in this zone. However, the compatibility between EP copolymer and PP decreases as the ethylene content increases, and the dispersed particles increase in size. When the EP copolymer particle size becomes larger, impact resistance and tensile elongation deteriorate. For this reason EP copolymer with ethylene content of 30 – 40 wt% is often employed, considering a balance between the EP copolymer performance and the size of the dispersed particles. Thus it is desirable to minutely disperse EP copolymer particles having ethylene content of approximately 60 wt%. Because EP copolymer is polymerized with a heterogeneous catalyst, the ethylene constituent distribution and molecular weight distribution between molecules are broad. Therefore, its performance as an elastomer is not satisfactory. Fig 3 shows the graph of the filler materials that are used in the polypropylene fibre. Also the metallocen-based elastomer, e.g., ethylene-butene copolymer and ethyleneoctene copolymer polymerized using a homogeneous catalyst, is often added as an impact-resistance modifier. It is important to select a structure that will ensure a good property-modification effect.

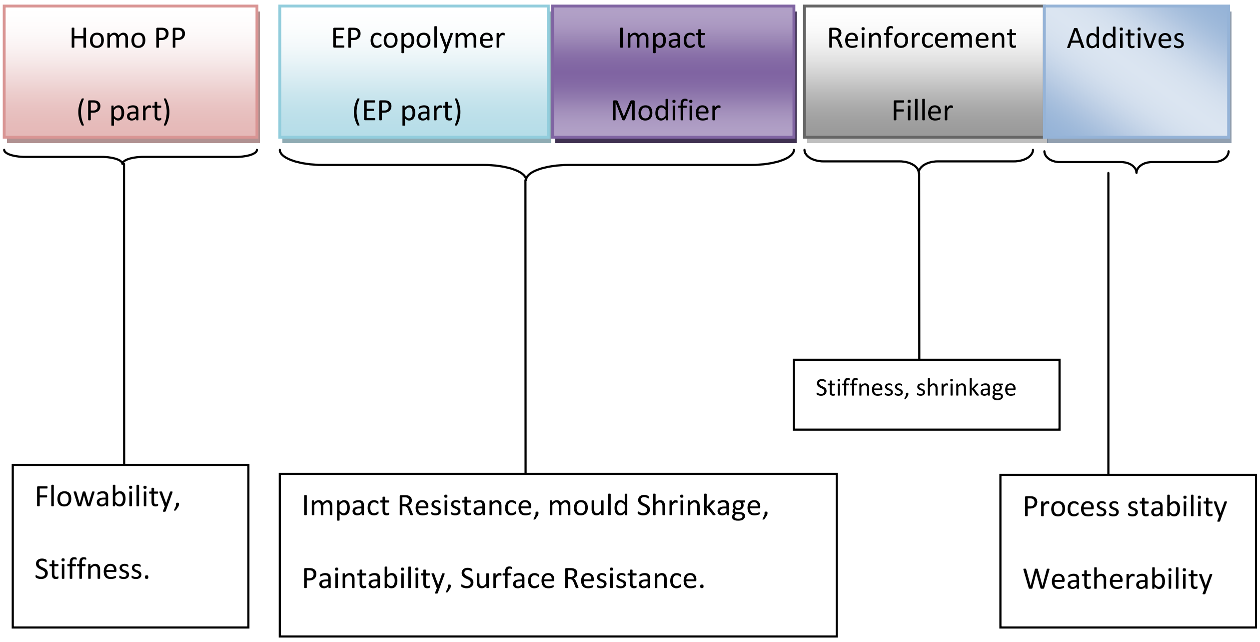
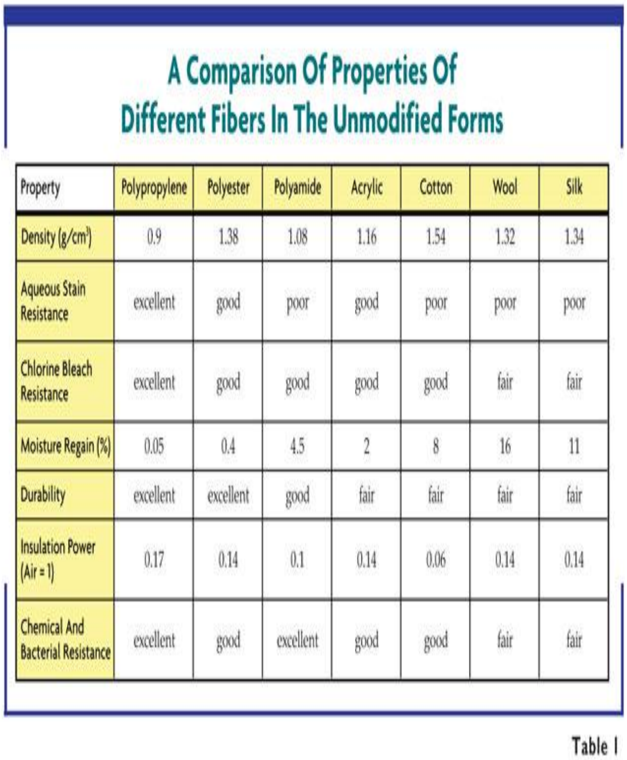


Fig. 1 Component of PP compound for automotive application



A Comparison Of Properties Of Different Fibers In The Unmodified Forms

Property	Polypropylene	Polyester	Polyamide	Acrylic	Cotton	Wool	Silk
Density (g/cm³)	0.9	1.38	1.08	1.16	1.54	1.32	1.34
Aqueous Stain Resistance	excellent	good	poor	good	poor	poor	poor
Chlorine Bleach Resistance	excellent	good	good	good	good	fair	fair
Moisture Regain (%)	0.05	0.4	4.5	2	8	16	11
Durability	excellent	excellent	good	fair	fair	fair	fair
Insulation Power (Air = 1)	0.17	0.14	0.1	0.14	0.06	0.14	0.14
Chemical And Bacterial Resistance	excellent	good	excellent	good	good	fair	fair

Table I

Fig. 2. Comparing the properties of the two

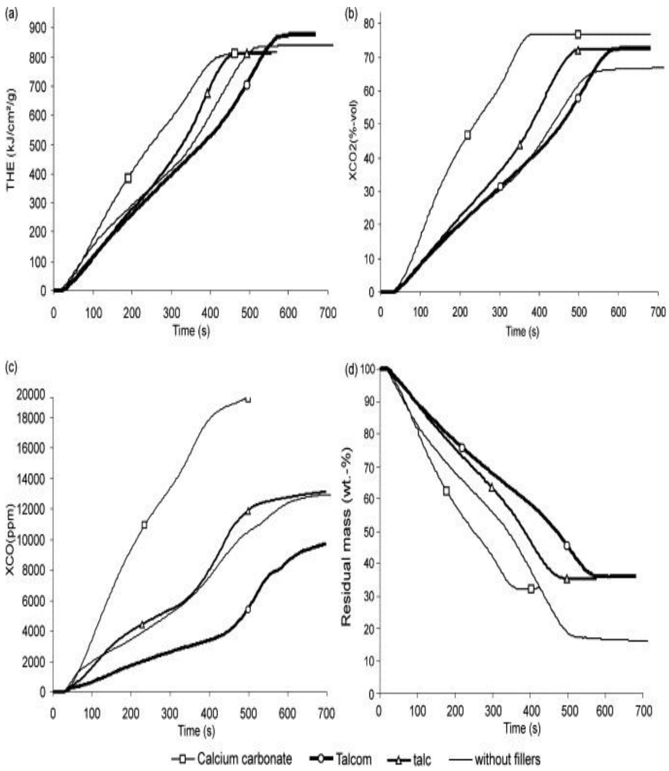
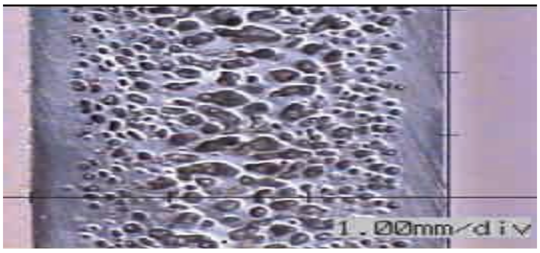


Fig. 3. Graph of different filler materials in PP

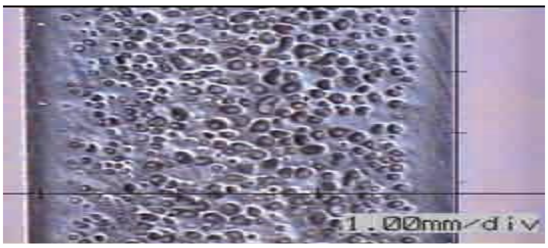
Conceptual diagram of molded article surface just after filling in mould.

Actual Surface of molded articles

Fig. 4. weld line forming process



Cross linked= 0% wt



Cross-linked PP =10wt%

Fig. 5. Effect of cross-linked PP on cell shape of PP foam articles

III. Reduction in Fuel Consumption

The reduction in the fuel consumption can be achieved by reducing the weight of the car parts. The changeover yielded substantially lower system costs and the replacement of steel with PP generated a weight saving of 35%, lowering overall vehicle weight by around 100 kg which can save fuel by the 10% around all the cars and also lowers the density, Fig 2. We have already seen the mechanical properties of the PP compound. The Fig. 4 shows the procedure of making the fibre. Also the weight can be reduced by the weight reduction technique by foam. The foam molding technique accommodates the need for weight reduction. Conventionally, the injection-foam molding technique using a thermolysis chemical foaming agent has been put to practical use. By melting and injecting the blend of PP resin and thermolysis chemical foaming agent using an injection-molding machine, foaming parts having high expansion ratios of up to two times the original volume can be obtained. These foaming parts are used for door trim and other, similar parts as shown in fig. 3 the graph of the different fillers used in the PP to make it more suitable. Regarding automotive interior parts, PP compounds are used for instrumental panels, door panels and pillars. Because these parts require the property of scratch-resistance, a coating is generally applied The foaming property of a material depends on the melt viscoelasticity and crystallization behavior of the resin. A material having the large swell ratio, which is the melt tension index, has air bubbles with high morphological stability, thereby forming a dense cell shape. Such material can be achieved using a cross-linked PP and PP having ultra-giant molecular weight. Shown in Fig. 5.

IV. Conclusion

It can be expected that, from this point forward, Polypropylene compounds will continue to play the primary role in resin materials for automotive applications due to their high cost-performance, outstanding moldability and environmental suitability. And its low ejection of the carbon dioxide helps for the environment. The diagram of the Formation of the Car parts made by the PP is shown. The weight of the different fibre is also shown in the table and hence by this way by reducing the weight can be achieved. And High Temperature resistant car can be obtained as the Ignition temperatutre of the compound is very high. As per study the reduction in weight is achieved up to 100 kg for almost every car hence it is expected that the average could be increased up to 4-5 liters per km. And the water absorption is negligible hence the rusting is avoided and hence the life of the car is increased and hence most importantly the reduction in the fuel consumption up to 10% can be achieved and in the end the economical and efficient car can be obtained.

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