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Research Paper

Characterization of ABS Material: A Review

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ABSTRACT: *Nowadays no one can deny the importance of PC/ABS alloy in our daily life. In this work, we present detailed Theoretical study of ABS material in various doping, surface finishing and polymerization techniques. The effects of metallization, Thermal Decomposition, polymeric varistor on ABS material have been investigated. A complete overview of various environment friendly techniques like nickel electroplating, copper metallization, surface etching and modification by treatment with atmospheric plasamaon ABS have been studied. On the other hand some mechanical characterization by Injection Molding and Fatigue crack propagation of PC/ABS alloy has been theoretically concluded.*

Keywords: *ABS, Atmospheric plasma, Metallization, Polycarbonate, pyrolysis, Surface Coating, Thermal degradation, Varistor*

I. INTRODUCATION

The Acrylonitrile-Butadiene-Styrene polymers are mainly consisting of three monomer units: Acrylonitrile, Butadiene and Styrene. Plastic has got many versatile properties which include thermal resistance, light weight, easy formability, reflectivity etc. Regarding all these properties it has opened new way of use for material like ABS/ PC. This emphasizes the importance of studying the recycling of ABS as an aid to reducing economic, environmental and energy issues. Metallization is a process in which a non-conductive material such as plastic is made conductive by providing conductive layer on it. Additives play considerable role in determining final properties of every polymer material [1-2]. To overcome this, a new approach was recently proposed based on the use of ionic liquids (ILs) as adjutants in ABS, enlarging the polarity range of these systems [3]. Due to combination of properties of the individual components, polymer blends provide an optimal price-service-ratio because of their higher performances characteristics at reasonable prices [4]. Introducing pores to the material system, helps in further weight reduction and energy absorption through large compressive deformation, and this is (Fabricating porous Structures) easier and cost effective compared to metals and ceramics[6].

An environment-friendly surface etching and activation technique for ABS material is a replacement for conventional chromic acid bath. By using this peel strength increases and adhesion strength reaches its maximum value [8]. If thermoplastic polymers (ABS/PC) were treated with atmospheric plasma, the slower the plasma treatment tends to the greater wettability of the treated polymers, somehow which gives idea about surface modification [9].During the recycling of ABS from waste electrical and electronic equipment (WEEE) voids defects can occur (caused by the evolution of volatile substances) and it was found that flexural strength and ductility in particular decreased with increased level of voids [10]. Nickel electroplating of ABS plastic has been achieved without any palladium pre-treatment which is environmentally friendly [11]. ABS material has wide range of application, and use of polymeric composites has grown at a rapid rate since 1960s. Hence in this review paper we are theoritically summing up all the physical and chemical properties of ABS/PC and its effect on environment.

II. LITERATURE REVIEW

2.1 Abs Material Metallization

In this work we studied electro less metallization of part material (Acrylonitrile-Butadiene-Styrene copolymer) on fused deposition modeling machining. Variety of plastics such as Teflon, Polythene and ABS can be metalized using different metals like silver (Ag), gold (Au), copper (Cu) and nickel (Ni), etc [22]. Generally in metallization plastic is made conductive by providing conductive layer on it. Once the ABS is coated with

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polypyrrole (PPy), Nickel elctroplating of ABS material can be achieved without chromium or palladium pretreatment.

2.2 Abs Material Thermal Decomposition

Thermal decomposition of acrylonitrile-butadiene-styrene (ABS) copolymer is generally carried out in presence of various Lewis-acid. Thermal Decomposition tells about flame retardancy in a Material. Conventional and most common flame retardants used in ABS are halogenated organic additives [25]. Introducing functionally grade porous to material system is helpful in case of weight reduction and maintains relative strength compared to metals and ceramics [6].

2.3 Abs Material Polymeric Varistor

Varistors shows a non-linear electric behavior upon polarization. Until now varistors have been built using ceramic materials and generally ceramic varistors are built of n-type semiconductor grains surrounded by insulating electrical barriers (At the grain boundary)[18]. In literature, we studied that an organic polymer varistor which shows non-linear coefficient is flexible, inexpensive, and stable. These devices were made up of conducting polymer, polyanilinr, acrylonitrile-butadiene-styrene copolymer and a low-cost dielectric polymer.

2.4 Abs Material Nickel Electroplating

Most common plate able plastic is Acrylonitrile Butadiene Styrene (ABS). Generally copper and nickel plated ABS is used in almost all decorative process or in the making of toys, automotive, computer body parts, electronic housing, pipes, and switches and in many more industrial application [4]. In this paper we studied that Nickel is electrodeposited as a top coating of the sample and direct metal electroplating process on ABS, which is an environment friendly coating method that decreases costs and steps of the conventional metallization process largely used in plating industries.

2.5 Abs Material Copper Metallization

In this work we studied that an environmental-friendly surface metallization on ABS copolymer as a replacement of conventional chromic acid etching bath [8]. By using copper metallization its peel strength and adhesion strength improves, and at 50 degree Celsius temperature adhesion strength reaches its maximum value. It's also theoretically studied that there is no difference between "Cu and Pd" catalyst on crystalline of elecroless plated copper film.

2.6 Abs Material Surface Etching

Surface etching of ABS Using eletroless deposition method is responsible for achieving good conditions for metal - plastic bonding and we studied that chromic acid etched samples shows better electrical performance. Etching generally provides anchoring sites for activator material, increase in the surface area and some residual remaining also got eliminated in the etching [22].

2.7 Abs Material Modifications by Treating With Atmospheric Plasma

If we treated two engineering thermoplastic materials (polycarbonate and acrylonitrile butadiene styrene copolymer) with atmospheric plasma torch then we found that slower the atmospheric plasma treatment tends to greater wettability of the treated polymer [9]. This wettability increases due to formation of C=O, C-OH, and R-COO polar group. This effect is also effected by treatment speed and generally atmospheric plasma treatment is more effective on ABS material rather than on PC.

2.8 Abs Material Polymerization Techniques

ABS copolymer has various properties like its light weight, good strength which makes it useful in industrial applications. Main drawbacks of Acrylonitrile-Butadiene-Styrene are its implicit flammability, and therefore there is a need to increase its thermal stability. So by using polymerization with high impact polystyrene (HIPS) we improves its FR (fire retardency).

2.9 Abs Material Mechanical Characterizations By

2.9 (A) Injection Molding Of Pc/Abs Alloy

Mechanical properties of ABS material prepared by injection moulding are far superior in various test (higher material compaction) than those in the case of 3-D printing [19]. Mechanical properties were studied with the help of tensile tests. It shows that elastic modulus and tensile strength decreases with decrease in density. Foaming technologies, like microcellular injection molding process permits manufacturers to decrease weight, amount of materials, less clamping force in plastic materials [29].

2.9 (B) Study of Fatigue Crack Propagation

Many engineering materials are made up of polymers; hence study of fatigue failure which is considered to be very dangerous is very necessary. It is studied that in smooth features crack growth rate is low whereas in case of porous features the crack growth is very high[24].

III. RESULT AND CONCLUSION

Acrylonitrile-Butadiene-Styrene copolymer got many properties which include light weight, easy formability, abrasion resistance, etc. This is useful for industrial application, making decorative, wheel covers, air conditioning parts, plastic metallization serves to make electronic housing which shows it will be a demanding material in near future. In this work we theoretically studied various properties and scope of ABS copolymer briefly.

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