



**Mechanical Engineering Study Program  
Faculty of Engineering  
Tarumanagara University  
Jakarta**

# The Effect of Silicone Coating Emulsion on Polycarbonate Helmet Glass

Ayra Diputera Hardjo<sup>1</sup>, Erwin Siahaan<sup>2</sup>, Abrar Riza<sup>3</sup>  
Fakultas Teknik, Program Studi Teknik Mesin  
(515190042)<sup>1</sup>

**Abstract:-** Coating is a method or technique to cover the surface of the substrate with the aim of protection, decorative and other purposes. coating is a more general term for a variety of materials that can be applied as a thin layer to a surface. Paint is traditionally described as a material having a color pigment used to coat a surface, the coating may be either a liquid or a solid material. coatings are known and used since ancient times and to protect various kinds of objects and buildings. Emulsified silicone is a term generally used to describe a group of hydrophobic polymeric and monomer compounds composed of silicon-oxygen bonds and given the name organosiloxane, because of their viscosity and ability to repel water, they are referred to as oils. Polycarbonate helmet visors are the material used today. Plastic Helmet Glass (Polycarbonate) has advantages and disadvantages, the first advantage of plastic helmet glass is that it is flexible. The flexibility it has makes it more resistant to receiving impact impacts when incidents occur. Polycarbonate can withstand impacts 30 times better than glass, that's why most helmets now use this material. However, the drawback of plastic visors is that they are not scratch resistant. To resist scratches on this polycarbonate helmet glass, it must be covered with a coating.

**Keywords:-** Coating, Emulsified Silicone, Polycarbonate, Helmet Visor.

## I. INTRODUCTION

Coating is a method or technique to cover the surface of the substrate with the aim of protection, decorative and other purposes. Coating is a more general term for any material that can be applied as a thin layer to a surface. Paint has traditionally been described as a material having colored pigments used to coat a surface; coatings can be either liquid or solid materials. Coatings are known and used since ancient times and to protect various kinds of objects and buildings. Coatings can be colored or not, and can be a transparent solid layer. Coating is more synonymous with coatings used in the industrial world, and paint refers more to coatings used on objects related to architecture, such as houses, walls and ceilings, roofs, fences and others. The coating is in the form of liquid silica oxide which can harden or crystallize so that it looks like a thin acrylic layer when it dries. This layer will keep the paint from scratching easily.

The process of applying this coating can be applied to the visor/helmet glass made of polycarbonate using an applicator pad, one of the methods to prevent scratches on the visor is by coating. Coating functions as a protective layer for any material and can be used in the automotive industry. Coating also has many advantages, namely having high resistance so that the color and luster of a specimen can last longer than not using coating, has high durability, is anti-dust, and is also resistant to scratches. Coating application requires skilled workers and special equipment. If it is not done properly or professionally, the appearance can look bad and its function is reduced, the application takes quite a long time because it needs perfect drying in

order to produce good coating results. material or coating material is quite high.

Silicone emulsion is a term generally used to describe a group of hydrophobic polymeric and monomer compounds composed of silicon-oxygen bonds and given the name organosiloxane, because of their viscosity and ability to repel water, they are referred to as oils.

The purpose of this study was to determine the characteristics of the coating on the helmet visor made of polycarbonate which is used as one of the helmet protectors, and to determine the value of the impact force on the polycarbonate material which is coated with a coating using a charpy impact test tool so that it is able to provide scratch resistance to the helmet glass.

The benefits obtained from conducting research in the form of testing in this experiment are being able to provide a reference to helmet glass manufacturers so that they are able to utilize the coating on their helmet glass so that they are of higher quality and more safety optimally, as well as providing a reference to Tarumanagara University in operating the impact testing machine according to with indicators of impact testing in automotive companies.

**II. RESEARCH METHODS**

The flowchart of the research process so that the implementation of this research runs smoothly is as follows :

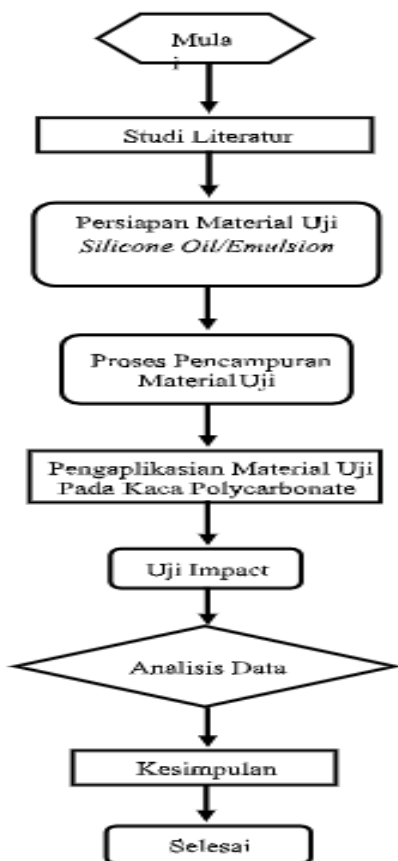


Fig 1 Diagram

The research started from preparing specimens of polycarbonate material that had been coated & which were not coated because the differences between each specimen would be seen and the impact force would be tested using a charpy impact testing machine.

➤ *Material*

The work material used in this study is a glass specimen sample made from polycarbonate material which is the same as a helmet glass material, the work material uses polycarbonate glass which has not gone through a coating process and which has undergone a coating process using a base material consisting of Silicone. Oil, Glycerin, Sodium Silicate, Aqua Distillation are the main ingredients for making the liquid coating. Meanwhile, after mixing these materials, they can be directly used as a coating for helmet visors made of polycarbonate material.

- *Polycarbonate Glass*

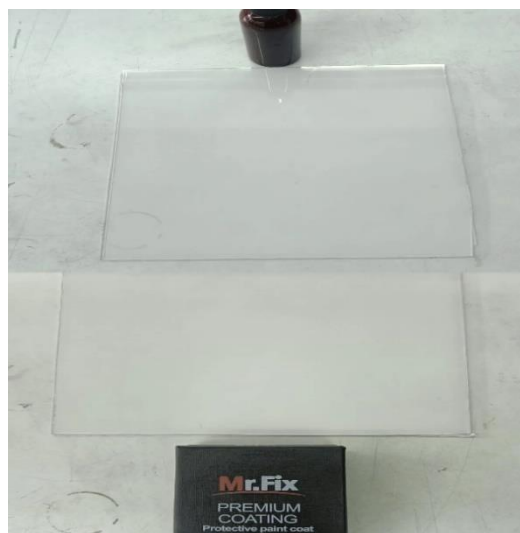


Fig 2 Polycarbonate Glass

- *Silicone Oil*



Fig 3 Silicone Oil

- *Glycerin*



Fig 4 Glycerin

- *Aqua Destilasi*



Fig 6 Aqua Destilasi

- *Natrium Silikat*

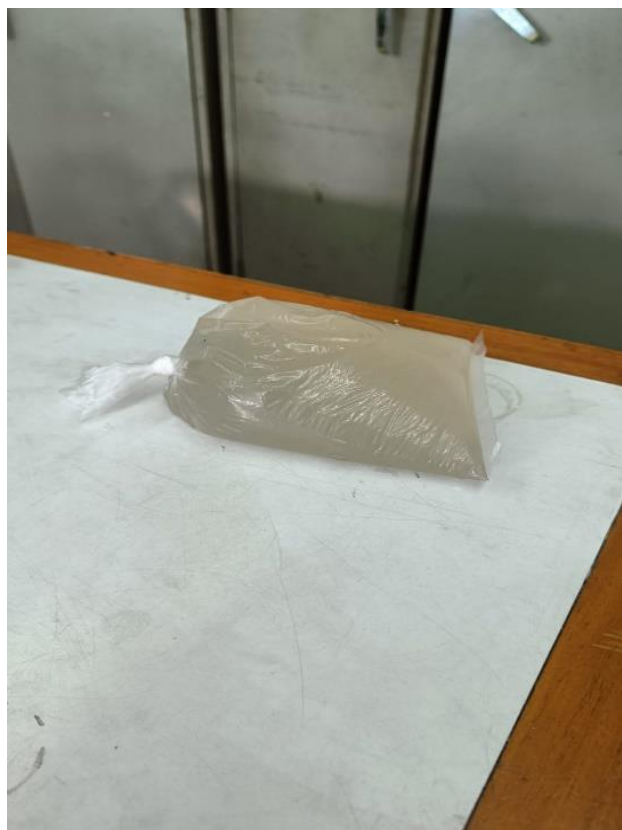


Fig 5 Natrium Silikat

- *Tools*

Equipment used in research, namely :

- *Impact Tools Test*

The Charpy impact test tool is used to test material hardness, the purpose of impact testing is to determine the resistance of a material to shock loads. The magnitude of the impact value indicates the material's ability to withstand loading. This test is carried out on a testing machine designed to have a pendulum of a certain weight swinging from a height to apply a shock load.



Fig 7 Impact Charpy Tools Test

• *Another Support Tools Test*

Supporting tools were used for the needs of the research, consisting of measuring cups, cutters, wooden chopsticks, microfiber cloths.



Fig 8 Supporting Tools Test

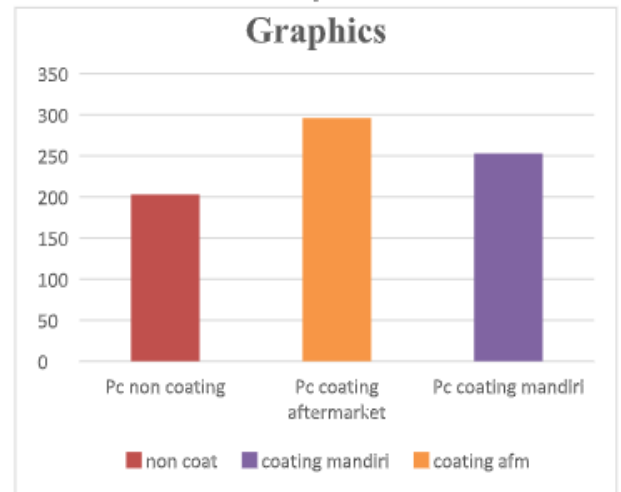


Fig 9 Impact Test Graph

**III. RESULTS AND DISCUSSION**

➤ *Impact Test Results on Helmet Visors*

The graph of the impact test results on the polycarbonate helmet glass material with a height of 1.5 meters shows that the magnitude of the force is different, as shown in Figure 9

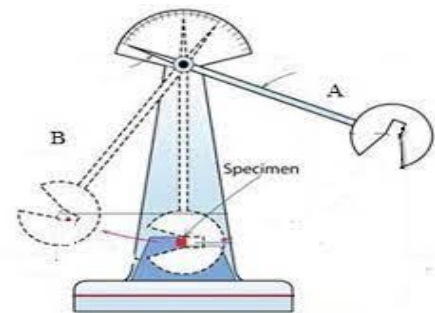


Fig 10 Impact Test

Table 1 Impact Test Results on a Polycarbonate Helmet Visor with a Height of 1.5 Meters.

No. Sample	Luas area impak A (mm <sup>2</sup> )	Gaya Pengujian F (N)	Tegangan yang terjadi $\alpha$ (MPa)	Explanation
1	350	203	0,933	Scratch
2	350	295	1,172	Scratch
3	350	253	0,981	Scratch
<b>Average</b>	350	244,33	1,029	

**IV. CONCLUSION**

➤ *Based on the data from the experimental process that has been collected, it can be concluded that the results of this study are :*

- The results of the analysis of the impact test on the helmet visor made of polycarbonate found that sample 1, 2, 3 were different due to the fact that the helmet visor had been coated and not coated, making the level of each stroke unequal.
- Based on the results of the stress that occurs, it can be concluded that aftermarket coatings and self-coating are different, this is due to several differences in the mixture of materials in the self-coating manufacturing process.

**REFERENCES**

- [1]. MINISTER OF MANPOWER. (2016). SKKNI 2016-091 COATING.
- [2]. Josep, V. K. (1995). Paint and Coating Testing Manual. Astm. <https://doi.org/10.1002/col.5080200415>.
- [3]. Husnur Rosyidah Aulia. (2021, Januari 26). "Apa Itu Coating?" [Online]. Available: <https://wira.co.id/coating-adalah/>.
- [4]. Barca, F., Caporossi, T., Rizzo, S. (2014). "Silicone Oil: Different Physical Proprieties and Clinical Applications." Hindawi Publishing Corporation, Via Paradisa 2, 56124 Pisa, Italy.
- [5]. Pal, R., Bhattacharya, S.N. and Rhodes, E. Flow behaviour of oil-in-water emulsions. Can. J. Chem. Eng. 64,3-10 (1986).
- [6]. Mehta, S.C., Somasundarana, P. and Kulk-arni, R. Variation in emulsion stabilization behavior of hybrid silicone polymers with change in molecular structure: phase dia-gram study. J. Colloid Interface Sci. 333,635-640 (2009).