Reducing Shining Surface Defects on Housing Components Through Process Optimization

MBKM Independent Study Final Report

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Politeknik Negeri Batam
2026

Statement of Authenticity of Final Project

I, the undersigned, certify that the contents of part or all of my Final Project entitled: "Reducing Shining Surface Defects on Housing Components Through Process Optimization" is my **own work, completed without the use of materials that are not permitted, and is not the work of other parties which I acknowledge as my own work.** All references cited or referred to have been written in full in the bibliography. If it turns out that my statement is not true, I am willing to accept sanctions in accordance with applicable regulations.

Batam, 30 July 2026

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Approval sheet

The Final Project is structured to fulfill one of the requirements for obtaining a degree
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Abstract

The automotive industry demands flawless components. A critical "shining surface" defect on nylon housing parts during the pressing process caused significant financial losses, with 2,494 rejected parts recorded in just two days. This research aims to identify the root causes of this defect and determine the optimal process optimization strategy to eliminate it completely. An experimental design methodology was applied on the production line to evaluate two variables: four alternative cushioning materials for the jig contact area (n=30 each) and five holding pressure levels (n=15 each). Results showed that adjusting holding pressure failed; reducing pressure eliminated the shine but created structural gaps. Conversely, modifying the jig's contact material was highly effective. Both Polyurethane shore 60A and Foam Tape achieved a 100% defect reduction rate. Ultimately, Polyurethane shore 60A is recommended for implementation due to its significantly superior long-term durability and wear resistance compared to Foam Tape.

Keywords: Surface Defects, Root Cause Analysis, Manufacturing Quality, Premium Automotive.

Foreword

The author would like to express his gratitude and thanks to God Almighty for His abundant blessings and grace, which enabled him to successfully complete his final project proposal at the manufacturing company. This final project proposal was written as a form of accountability for the author's internship process and as one of the requirements for graduating from the industrial internship course in the Electronics Engineering program Manufacturing program at the Batam State Polytechnic. In preparing this final project proposal, the author received assistance from several parties, so on this occasion, with all humility and respect, the author would like to express his deepest gratitude to:

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Bayu Dermawan Ramadhani

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Keywords: Surface Defects, Root Cause Analysis, Manufacturing Quality, Premium Automotive.

Introduction

The modern automotive manufacturing sector operates under stringent quality control standards, demanding high precision and flawless aesthetic finishes for all vehicle components to improve the overall quality level [1]. Maintaining this perceived quality is a fundamental requirement in the automotive industry to satisfy customer expectations [2]. Within this context, the assembly of nylon housing units requires a meticulous mechanical pressing operation to integrate the structural parts securely. Achieving consistent defect reduction is a primary challenge, as material variability can significantly impact the production process of automotive parts [3].

However, the direct mechanical contact involved in this manual pressing process frequently induces an unintended 'shining surface' anomaly on the upper contact area of the housing. This localized visual defect violates the strict cosmetic requirements of the product, resulting in significant material rejection and financial loss.

Evaluating the cost of poor quality is essential, as production quality costs directly affect the profitability of the manufacturing industry [4]. Furthermore, assessing the impact of continuous quality improvement on production defectiveness is highly necessary to maintain operational efficiency and competitiveness [5].

The application of quality tools has been proven effective in identifying and reducing surface defects within manufacturing environments [6]. Building on this principle, to systematically investigate the origins of this surface defect, an Ishikawa (Fishbone) diagram was utilized to map potential root causes across various manufacturing parameters. This diagnostic approach allowed for a structured evaluation of the tooling variables.

The primary objective of this research is to identify the precise mechanical factors contributing to the shining surface defect and to implement an optimal process modification that completely eliminates the anomaly without compromising the structural integrity of the assembly.

The optimization of pressing processes requires a deep understanding of how polymer materials react to mechanical stress and thermal variations. According to [7], pressure and temperature are fundamental parameters governing the physical and mechanical behavior of polymer composites. In the context of manual jig pressing, controlling these variables—particularly local friction and uneven pressure—is essential to prevent morphological changes and surface defects.

The mechanics of material contact further explain these surface vulnerabilities. Research highlights that scratch hardness and material deformation—whether through elastic recovery in materials with low Young's modulus or plastic pile-up in stiffer materials—are critical when analyzing surface defects [8]. Building on this, [9] found that the scratch resistance of polyamides (a common automotive plastic) is directly correlated with operational factors like contact load, tool geometry, and interface lubrication. Therefore, the literature strongly suggests that mitigating "shining surface" defects requires optimizing the mechanical parameters of the pressing jig, proving that process optimization is a more effective strategy than altering the base material.

The investigation into surface anomalies was initiated following a customer complaint identifying four delivered units with "shining surface" defects. To determine the severity and scope of the issue, a comprehensive screening was conducted on the production output for the affected housing components over a two-day period. The inspection identified a substantial total of 2,494 rejected units (Not Good/NG) exhibiting the shining surface defect. The distribution of these defects, categorized by date and operator group, is detailed in Table I.

TABLE I SCREENING SHINING SURFACE					
No	Date	NG Qty	Relative Frequency (%)	Cum	Cumulative Frequency (%)
1	03/09/25 Linaria&Alfis	108	4,33	108	4,33
2	03/09/25 Layina	7	0,28	115	4,61
3	04/09/25 Fardila&Anisa	1601	64,19	1716	68,81
4	04/09/25 Denilam	578	23,18	2294	91,98
5	04/09/25 Atalla	200	8,02	2494	100,00
	Amount	2494			

To analyze the screening results comprehensively, the relative percentage, cumulative number, and cumulative frequency for the defective units were calculated. The formulas used to derive the values in Table I are as follows:

$$Relative\ Frequency\ (\%) = \frac{NG\ QTY}{Amount} \times 100 \qquad (1)$$

Where:

- *Relative Frequency (%)* is the percentage of defective components identified per screening session.
- *NG Qty* is the number of "shining surface" defects found by the screening personnel.
- *Amount* is the total number of defective components across all sessions (2,494 units).

$$Cum_n = Cum_{n-1} + NG\ Qty_n \qquad (2)$$

Where:

- Cum_n is the cumulative number of defects up to the n-th row.
- Cum_{n-1} is the cumulative number of defects from the preceding row.
- $NG\ Qty_n$ is the number of defects found in the n-th row.

$$Cumulative\ Frequency\ (\%)_n = \frac{Cum_n}{Amount} \times 100 \qquad (3)$$

Where:

- $Cumulative\ Frequency\ (\%)_n$ is the cumulative percentage of defects up to the n-th row.
- Cum_n is the cumulative number of defects up to the n-th row (derived from Equation 2).
- *Amount* is the total number of defective components (2,494 units).

As illustrated in Table I and calculated using the equations above, the occurrence of "shining surface" defects was highly concentrated during specific screening sessions. Most notably, a single inspection group (Fardila & Anisa) identified 1,601 defective parts, using the calculation in formula (1), the group recorded a percentage of defective components identified per screening session of up to 64,19%.

This massive volume of rejected parts confirms the severity of the issue reported by the customer. Because these figures reflect the screening output rather than the source of the defect itself, it was determined that the root cause lies earlier in the production line. This baseline data underscores the critical need to optimize the mechanical contact parameters of the pressing jig to eliminate the anomalies at their source.

To understand the defect mechanism, the physical structure of the product must first be defined. The primary subject of this research is a nylon housing assembly, which requires a precise mechanical pressing operation to integrate the top and bottom components.

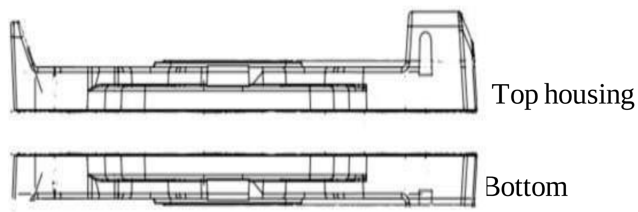

Figure 1. Housing top and bottom(side view).

As shown in Figure 1, this side-view illustration demonstrates the structural profile of both the top and bottom housing units prior to their integration.

To achieve this integration, the production line relies on specific mechanical equipment. This assembly process utilizes a specialized manual pressing jig designed to apply specific downward force.

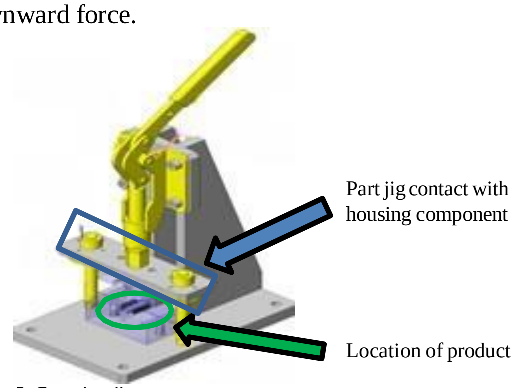

Figure 2. Pressing jig.

As detailed in Figure 2, the machine features a lever mechanism that drives the tooling downward onto the base plate. The critical interaction during this operation occurs at the interface where the plastic contact point of the pressing jig meets the top housing to secure the assembly.

The quality standards for these manufactured components strictly prohibit visual anomalies, including unintended surface gloss. However, the direct mechanical contact between the pressing jig and the top housing frequently induces localized "shining surface" defects along the upper contact area.

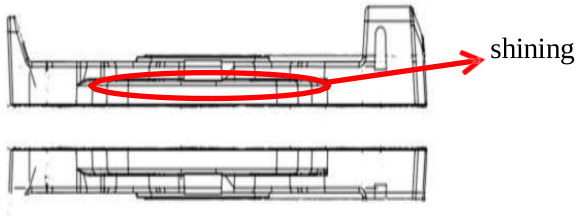

Figure 3. Area shining surface.

The red highlighted region in Figure 3 pinpoints exactly where the top housing sustains this friction-induced damage during the downward stroke of the pressing cycle.

To fully grasp the severity of this visual anomaly, a physical comparison between passed and failed components is necessary.

Figure 4. Comparison Bad Part and Good Part.

As illustrated in Figure 4, an acceptable unit exhibits a uniform texture, whereas defective units display a distinct, unacceptable shining surface exactly where the mechanical pressure is applied. The white arrows on the defective part clearly indicate these localized shining areas, which fail to meet the required visual standards. This direct correlation between the jig's contact footprint and the defect locations indicates that evaluating and optimizing the physical interaction between the tooling and the component is necessary to resolve the issue.

The main goal of this work is to stop the jig from making the shining surface. The researcher will design a new design for the pressing jig and test it carefully. This new design will have a better shape and will push with the right amount of heavy force. When the new design is finished, the company will make perfect parts again. The work will be smooth and fast, and the company will not waste money on broken parts. This project will also give the engineers a very good lesson about how to build better jig in the future.

Method

2.1. Research Flow and Data Collection

The utilization of a research flowchart provides a clear visual representation of the methodology, ensuring a systematic and logical study progression from problem identification to the implementation of solutions [10]. Furthermore, process mapping and flow diagrams are widely recognized as essential tools in engineering research to accurately communicate complex analytical steps, standardize workflows, and identify areas for structural improvement [11]. To ensure a systematic and structured approach to mitigating the shining surface defects, the research methodology was divided into several sequential phases. The complete progression of this study, bridging theoretical analysis with practical execution, is depicted in the research flowchart presented in Figure 5.

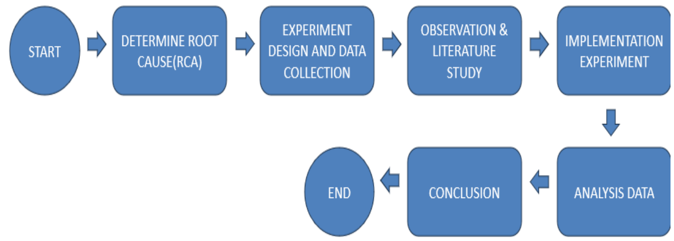

Figure 5. Research Flowchart.

As illustrated in Figure 5, the research sequence commenced with identifying the core problem, followed by comprehensive data collection from the production line. Subsequently, a root cause analysis was conducted utilizing a Fishbone diagram to isolate and pinpoint the primary manufacturing variables contributing to the defect. Guided by this diagnostic analysis, targeted experiments were then executed to evaluate the suspected variables objectively. The optimized process parameters derived from these experimental trials were subsequently implemented directly on the production line. Finally, the research process concluded with a comprehensive evaluation to verify the effectiveness of the applied solutions.

The research commenced with the precise identification and scope limitation of the "shining surface" defect on the nylon housing components. To systematically map and analyze the origins of this anomaly, an Ishikawa (Fishbone) diagram was utilized (Figure 6). This diagnostic tool categorizes the potential root causes into four primary manufacturing domains: Material, Man, Method, and Machine.

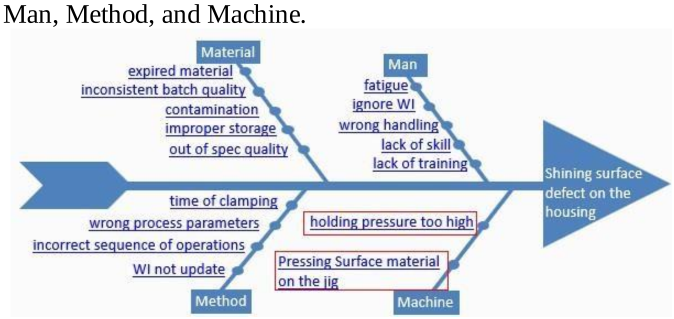

Figure 6. Ishikawa Diagram for Shining Surface Defect Cause Analysis.

The Fishbone diagram is a highly effective tool used to identify, systematize, and analyze the diverse sources of production problems [12]. By implementing this structured root cause analysis method, company management can make accurate, data-driven decisions to eliminate manufacturing defects [13][14].

To transition these potential hypotheses into verified actual root causes, a rigorous, multi-tiered validation process was conducted. For variables related to 'Material', 'Man', and general 'Method', primary data was gathered through direct observation on the production floor, structured interviews with operators, and historical data retrieval from relevant departments. Furthermore, operational standards were thoroughly audited by reviewing critical engineering documents, including Work Instructions (WI), Process Flow Diagrams (PFD), and Control Plans (CP). This comprehensive screening effectively ruled out human error, material contamination, and general procedural deviations as the primary drivers of the defect.

Consequently, the investigation successfully isolated two actual root causes (highlighted in red, Figure 6)—namely, " pressing surface material" and the "holding pressure too high"—through the execution of targeted experimental designs. Specifically, the isolation and verification of these two root causes were achieved by conducting a physical trial utilizing 60 component samples to evaluate the impact of the jig's contact surface material, alongside an additional trial of 30 samples dedicated to assessing variations in holding pressure levels. The comparative results from the first trial evaluating the pressing surface material are presented in Table II.

TABLE II
EXPERIMENTAL DESIGN FOR PRESSING SURFACE MATERIAL

Group	Pressing surface material	Total samples	Conforming Qty	Acceptance Rate (%)
1	Bare condition (no additional material)	30	20	66,67
2	Polyurethane (PU) Shore 80A	30	23	76,67

the percentage of acceptable components—referred to as the acceptance rate—was calculated. The formula used to derive the percentage values presented in Table II is as follows:

$$Acceptance\ Rate\ (\%) = \frac{Conforming\ Qty}{Total\ Samples} \times 100 \ldots\ldots\ldots(4)$$

Where:

- *Acceptance Rate (%)* is the proportion of products that successfully meet quality standards.
- *Conforming Qty* is the number of component samples that passed inspection without exhibiting the "shining surface" anomaly.
- *Total Samples* is the total amount of components tested within each specific experimental group (30 units).

As detailed in Table II, preliminary experiment evaluating the pressing surface material, testing was conducted on 60 samples divided into two equal groups. The first group of 30 samples was processed without any additional material on the jig's contact surface (bare condition). Conversely, the second group utilized Polyurethane (PU) Shore 80A as a contact layer, leveraging the material's specific damping capabilities under mechanical stress [15]. By using formula (4), the results showed that the first group made only 66,67% defect-free products, while the second group improved slightly to 76,67%. This initial data demonstrates that under identical pressure conditions, modifying the pressing surface material influences the yield rate of acceptable products. Consequently, further investigation is required to identify the most optimal material to be implemented on the jig's contact surface.

Furthermore, a secondary experiment was conducted to assess the impact of holding pressure levels. This test utilized 30 samples evaluated under two distinct conditions, with 15 samples per condition. Condition 1 represented the current standard parameters, which historically produced the "shining surface" anomaly. Under this baseline condition, 10 out of 15 samples were defect-free, while the remaining 5 exhibited the shining defect. In Condition 2, the pressing force was increased above the standard parameters. The results from this elevated pressure condition revealed a 100% defect rate, with all 15 samples exhibiting the "shining surface" anomaly are presented in table III.

TABLE III
EXPERIMENTAL DESIGN FOR PRESSURE LEVELS

Condition	Description of testing	Total Samples	Defect-Free Quantity	Process Yield(%)
1	Standard Position (baseline)	15	10	66,67
2	Turn clockwise (tighten) 2 full turns (720°)	15	0	0

To evaluate the impact of mechanical force on product quality, the process yield percentage for each holding pressure condition was calculated. The equation used to determine the process yield values presented in Table III is as follows:

$$Process\ Yield(\%) = \frac{Defect{-}Free\ Quantity}{Total\ samples} \times 100 \ldots\ldots\ldots\ldots\ldots (5)$$

Where:

- *Process Yield (%)* is the percentage of acceptable products under a specific pressure condition.
- *Defect-Free Quantity* is the number of component samples that did not exhibit any "shining surface" anomalies.
- *Total Samples* is the total amount of components evaluated for each specific condition (15 units).

As detailed in Table III, the secondary experiment evaluating holding pressure levels utilized 30 samples divided into two distinct conditions. Calculated using formula (5), the baseline setup (Condition 1) achieved a 66.67% success rate, producing 10 defect-free samples out of 15. Conversely, Condition 2, which utilized a higher pressing force, resulted in a 0% yield because every sample developed a "shining surface" defect. This empirical evidence confirms that excessive holding pressure is a critical factor in the formation of surface anomalies during the assembly of the nylon housing components.

Based on the empirical evidence derived from the pressing surface material and holding pressure experiments, a comprehensive corrective action plan was formulated to systematically eliminate the "shining surface" anomalies.

First, regarding the pressing surface material, while the application of Polyurethane (PU) Shore 80A yielded a marginal improvement over the bare condition, the resulting 33% success rate, calculated using formula (4), remains insufficient to meet mass production standards. Therefore, the primary corrective action involves conducting further material selection trials to identify, validate, and implement a more optimal cushioning material. This material must possess the exact properties required to absorb and distribute mechanical stress without leaving surface impressions on the nylon housing.

Second, addressing the holding pressure parameters, the data conclusively demonstrated that increased holding pressure is a primary catalyst for the defect. Consequently, establishing the exact optimal holding pressure necessitates conducting further experimental iterations. Future trials must evaluate a wider range of pressure variables—exploring both reduced and moderately increased force levels—while strictly avoiding the excessive tension applied in the recent experiment. This systematic approach will ensure the identification of a precise pressure threshold that maximizes product yield without inducing surface defects.

2.2. Technical Testing

Based on preliminary verification, two primary root causes were identified as the triggers for the shining surface defect on the housing components:

1. Pressing surface material
2. Holding pressure too high.

To determine the optimal parameters for both identified factors, a systematic optimization phase will be executed. Regarding the pressing surface material, a comparative analysis of various cushioning materials with distinct mechanical properties will be conducted to identify the ideal contact layer. Concurrently, to address the holding pressure, a series of experimental trials will be performed across a controlled range of force levels. This systematic approach aims to pinpoint the precise threshold where the mechanical pressure is sufficient for robust component assembly, yet adequately minimized to prevent the occurrence of shining surface anomalies.

2.2.1. Material Evaluation (Pressing surface material)

Initial analysis indicated that the pressure generated at the contact area between the plastic jig and the housing surface caused micro-deformations and texture changes in the material. This deformation increased light reflectivity, triggering the shining surface defect. To address this, a comparative sample test was conducted to identify alternative materials that do not induce this effect.

The materials evaluated included polyurethane(PU) shore 60A, rubber mat, silicone rubber, and foam tape. These materials were applied to the surface of the jig that comes into contact with the housing. Thirty test samples (n=30) were prepared and tested for each material type. The test results were then validated to determine which material was the most effective in eliminating the shining surface on the housing.

During the experiment, each selected material was individually applied to the contact surface of the jig. Following the production cycle, each of the 30 resulting housing components underwent a rigorous visual inspection. The evaluation criteria were strictly categorized into two binary outcomes: "Good" (indicating the complete absence of the shining surface defect) and "No Good" or "NG" (indicating the presence of the defect). The data collected from these trials was then aggregated to calculate the success rate percentage for each material, which served as the basis for selecting the optimal solution.

2.2.2. Parameter Optimization (Addressing Holding Pressure level)

The second experimental phase tested the hypothesis that excessive holding pressure contributes significantly to the shining surface defects. Theoretically, excessive injection and holding pressures can cause material overpacking in the contact area between the jig and housing, producing micro-deformations that reflect light abnormally. Initial experiment confirmed a direct proportional relationship between the increased holding pressure and the severity of the defects.

A comparative experimental test was conducted by varying the holding pressure parameter across five distinct levels, deviating from the current standard production condition. The applied pressure was systematically adjusted by turning the manual control bolt.

Adjustments to the applied pressure were controlled through precise manual bolt rotations. Decreased pressure levels were achieved by turning the bolt to the left (loosening). Specifically, test code P-1 involved loosening the bolt by one full turn (360°), while P-2 involved two full turns (720°). Conversely, increased pressure conditions were tested by turning the bolt clockwise (tightening). Code P+1 represented an increase of one full turn (360°), and code P+2 represented an increase of two full turns (720°). For each designated pressure setting, a total of 15 samples were produced (n=15). Upon completion of the production cycle, all 75 components were visually inspected and recorded as either "Shining" (indicating a defect) or "OK" (indicating an acceptable surface).

The generated data from each tested setting was then evaluated to identify the optimal holding pressure threshold that minimizes the shining surface defect without compromising other product quality standards.This structured methodology provided a clear comparative framework to determine the optimal pressure threshold required to eliminate the surface defect.

Result and Discussion

This section presents the empirical results obtained from the experimental trials conducted to eliminate the shining surface defect on the housing components. The data analysis is divided into two primary evaluations based on the verified root causes: the assessment of alternative surface pressure materials and the optimization of holding pressure parameters.

3.1. Results of Pressing Surface Material Testing

As part of the process optimization to eliminate the shining surface defect, structural modifications were implemented on the pressure holder component of the jig. This modification was specifically designed to accommodate the addition of a cushioning layer at the direct point of contact. The visualization of the modified pressure holder is presented in Figure 7 below.

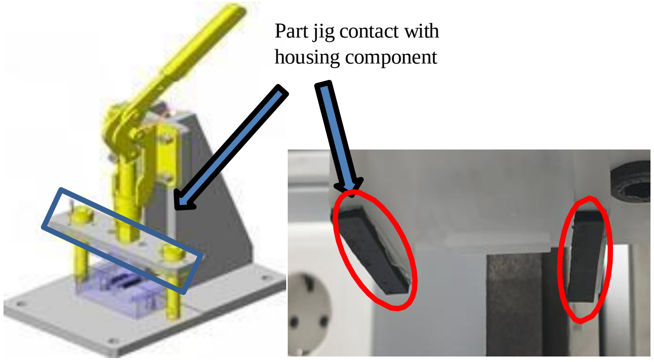

Figure 7. Modification Pressing Surface Material On The Pressing Jig.

Referring to Figure 7, the primary adjustment involves modifying the contact surface profile of the jig to integrate the cushioning materials. During the experimental phase, each tested material variant was firmly attached to this specific area of the jig. The application of the material at this contact point aims to serve as a buffer, completely preventing direct rigid plastic-to-plastic friction between the jig and the housing component.

To evaluate the efficacy of different cushioning materials in preventing direct plastic-to-plastic contact, five material variants were tested over 30 continuous production cycles (n=30). The summarized outcomes of these trials, categorized by the presence or absence of the shining surface defect, are presented in Table IV.

TABLE IV
SUMMARY OF PRESSING SURFACE MATERIAL EXPERIMENTS

Material Tested	Total Trials (n)	Good Product	Defect / No Good (NG)	Success Rate (%)
Polyurethane shore 60A	30	30	0	100
Rubber Mat	30	0	30	0
Silicone Rubber	30	15	15	50
Foam Tape	30	30	0	100

To understand how good each different material is, we can use a very simple rule to find the percentage of success. The simple formula used to find the clear percentage values shown in Table IV is written exactly like this:

$$Success\ Rate\ (\%) = \frac{Good\ Product}{Total\ Trials\ (n)}\ x\ 100 \text{ ....(6)}$$

Where:

- *Success Rate (%)* is the final percentage of the good and perfect products that were made during the testing time.
- *Good Product* is the number of nice items that passed the careful inspection without any bad defects or problems.
- *Defect / No Good (NG)* is the number of bad items that did not pass the careful inspection because they had mistakes or problems.
- *Total Trials (n)* is the complete and total amount of all the pieces that were carefully tested for each different material, which is exactly thirty units for every test.

As detailed in Table IV, the experimental data reveals a significant variance in performance among the tested materials. Polyurethane shore 60A and Foam Tape demonstrated the highest efficacy, calculated using formula (6) both achieving a 100% success rate with zero shining surface defects observed across all 30 trials. These results indicate that both materials possess optimal cushioning properties, effectively distributing and absorbing the mechanical pressure and friction exerted by the jig. By providing a softer buffer, they successfully prevented the micro-deformations on the housing surface that lead to abnormal light reflectivity.

Conversely, the Rubber Mat yielded the poorest outcome, calculated using formula (6) resulting in a 0% success rate as all 30 trials produced defective components. This suggests that the inherent rigidity and surface texture of the rubber mat failed to mitigate the contact stress. Meanwhile, Silicone Rubber showed inconsistent and suboptimal results, calculated using formula (6) with success rates of 50%.

To visually illustrate this stark contrast in material performance, Figure 8 provides a direct comparison between a defect-free housing component and one exhibiting the shining surface defect.

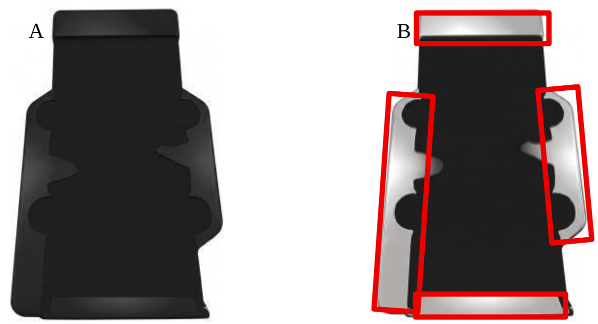

Figure 8. Surface outcome comparison of housing components. (A) Defect-free surface processed with Polyurethane shore 60A and Foam Tape. (B) Defective surface exhibiting localized shining patches processed with a Rubber Mat and Silicon Rubber.

As observed in Figure 8, the component processed using Polyurethane shore 60A and Foam Tape (left/A) maintains a uniform, matte surface finish, confirming the elimination of contact stress. In contrast, the component processed with the rigid Rubber Mat and Silicon Rubber (right/B) clearly displays the localized shining patches characteristic of the shining defect, validating the statistical findings in Table IV.

Based on these comprehensive findings, Polyurethane shore 60A and Foam Tape are identified as the most viable alternative materials to replace the standard rigid plastic contact on the production line.

3.2. Results of Holding Pressure Testing

In a separate phase of the optimization process, the evaluation focused on the mechanical parameters of the jig, specifically the holding pressure. To facilitate these precise adjustments, a tunable pressure mechanism on the jig was utilized. The configuration of this mechanical adjustment point is illustrated in Figure 9 below.

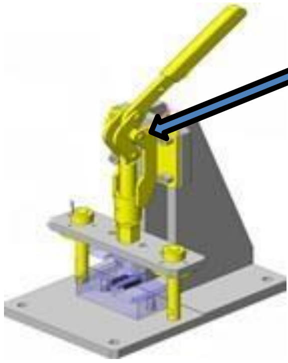

Figure 9. Modification Holding Pressure Level On The Pressing Jig.

As depicted in Figure 9, the holding pressure applied by the jig is directly regulated through this mechanical adjustment mechanism. During the experiment, the specific pressure levels were calibrated by physically turning this mechanism either counterclockwise to loosen (reducing pressure) or clockwise to tighten (increasing pressure).

The second phase of the experiment evaluated the effect of different holding pressure levels on the product surface. The pressure was adjusted across five levels, from P-2 (lowest pressure) to P+2 (highest pressure). The results of these 75 experimental trials are summarized in Table V.

TABLE V
SUMMARY OF PRESSURE LEVELS EXPERIMENTS

Test Code	Description of testing	Total of Sample	Result (Shining / OK)	Remark
P-2	Turn left (loosen) 2 full turns (720°)	15	OK	Many spots gap on product
P-1	Turn left (loosen) one full turn (360°)	15	OK	Any spot gap on product
P-0	Standard Position (Current Conditions)	15	Shining	Problem Condition
P+1	Turn clockwise (tighten) one full turn (360°)	15	Shining	Not recomended
P+2	Turn clockwise (tighten) 2 full turns (720°)	15	Shining	Not recomended

As shown in Table V, modifying the holding pressure produced mixed outcomes. Under the standard production setting (P-0), all 15 samples exhibited the shining surface defect. When the holding pressure was increased (test codes P+1 and P+2), the shining defect persisted on all samples. This confirms that increasing the pressure does not solve the problem and is not recommended.

Conversely, when the holding pressure was decreased (test codes P-1 and P-2), the shining surface defect was successfully eliminated. The surfaces of these samples were recorded as "OK." However, reducing the pressure introduced a new critical quality issue: physical gaps appeared on the product. The lowest pressure setting (P-2) resulted in many gaps across the product, while the P-1 setting resulted in some minor gaps. This secondary defect occurs because the reduced holding pressure is insufficient to fully pack and form the material inside the mold.

The analysis indicates that while lowering the holding pressure successfully mitigates the shining surface defect, it severely compromises structural integrity by inducing gap formation. Consequently, adjusting the holding pressure alone does not offer a viable standalone solution. Instead, these observations highlight that modifying the jig contact material—specifically utilizing Polyurethane Shore 60A or Foam Tape—remains the more optimal and effective strategy to eliminate the shining anomaly without introducing secondary defects.

Conclusion

This study aimed to eliminate the shining surface defect on housing components during the pressing process by investigating the effects of direct plastic contact and excessive holding pressure. The experimental findings demonstrate that modifying the jig's contact material is the most effective solution; specifically, the application of Polyurethane shore 60A and Foam Tape successfully prevented micro-deformations, achieving a 100% defect reduction with consistent product quality. Although both materials are equally effective at eliminating the shining effect and maintaining high quality, Polyurethane shore 60A proves to be significantly superior to Foam Tape regarding material durability and wear resistance over time. Conversely, adjusting the machine's holding pressure was found to be an unviable strategy, as lowering the pressure to mitigate the shine resulted in structural gaps, while increasing it failed to resolve the primary defect. Despite these conclusive results, this research is limited by its narrow scope, having evaluated only five alternative cushioning materials and relying on the manual adjustment of a single pressure parameter, without accounting for potential variations in raw material properties or human operator factors. Based on these findings and limitations, the implementation of Polyurethane shore 60A is recommended as the primary standard contact material for the jigs. Furthermore, it is suggested that future research should explore a broader spectrum of advanced, high-durability cushioning materials as well as conduct comprehensive multivariable analyses of the pressing machine's parameters to ensure sustained process optimization.

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