INCOMING CONTROL PARAMETERS FOR PVC SHEETS USED FOR THE PRODUCTION OF PLASTIC CARDS

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Abstract: One of the main requirements for obtaining high-quality raw materials for production is a clear formulation of the necessary parameters that the manufacturer of materials must comply with in the production of raw materials. The very observance of these parameters in the future will reduce the number of production of unsuitable products and plastic cards with defects.

Parameter control is carried out for each separate batch of materials. The sample during inspection should be at least 0.1 % of the total amount of material, the deviation from the parameters should be included in the tolerance.

The tasks of the stage of product quality control should ensure the implementation of the quality policy, as well as the general economic policy of the enterprise. Control is an integral part of the activities of any enterprise, a regulator of factors that form quality at all stages of the production process and ensure the release of quality products.

Based on the analysis and experimental studies, the main parameters that need to be monitored were determined: geometric dimensions, color, thickness, density, surface tension, tensile strength, uniformity of paint application, shrinkage during sheet sintering.

Keywords: plastic card, control method, measuring instruments.

1. Introduction

In improving the wear-resistant properties of the card, control of the parameters of the materials used in its production plays an important role. At the stage of incoming control, it is necessary to correctly control the compliance of these characteristics with the established standards. Deviation from the specified parameters can lead to problems in the production of cards at all its stages (printing, lamination, cutting, personalization, etc.). The purpose of this study was to improve the system of incoming control of materials intended for printing plastic cards, to analyze the parameters that need to be controlled and measuring instruments for their control.

2. Methods

The geometric dimensions of the PVC sheet were checked using an attorney ruler with a graduation of 1 mm. To check the color consistency, a spectrophotometer with an operating wavelength range of 380–730 nm was used, the surface roughness was determined on a profilometer with a discreteness of 0.01 μm and a measurement error of 5 %. Maximum shrinkage at 140 °C/10 min. was determined by means of a heat chamber and a measuring ruler with a discreteness of values of 0.5 mm. Indicator inks and markers were used to determine the surface tension, and as a result of measurements it was determined that more accurate results can be obtained using ink. Additionally, tests were carried out with offset and silkscreen printing on sheets and the subsequent production of a finished plastic card.

3. Results

Improving the production of products, increasing its efficiency, ensuring the competitiveness of products is impossible without the use of modern quality management's methods. International standard ISO 9001 series [1] recommends the use of a process approach, which is based on the concept of analyzing all types of enterprise activities as a logically ordered sequence of stages that process inputs into outputs. The principle of processity of the quality management system is interconnected with a systematic approach to management [1, 2], based on the creation of a system of interacting dynamic processes, the purpose of which is the interrelation of tasks arising within the framework of the quality concept, the application of the design style of work organization, the structuring of processes, continuous improvement of the system through a combination of gradual and discontinuous measures. The higher the product significance group, the greater the share of its assessment in the overall quality assessment. One of the main requirements for obtaining high-quality raw materials for production is a clear formulation of the necessary parameters that the manufacturer of materials must comply with in the production of raw materials. It is precisely the clear requirements that will reduce the number of nonconforming products.

At the stage of incoming inspection of materials intended for printing plastic cards, it is necessary to check for compliance with a number of parameters, such as surface properties, geometric dimensions, colors, thickness, etc.

Control is carried out by taking samples from a batch, their quantity depends on the total amount of material in the batch.

It should be noted that the quality of products and services depends primarily on the quality of their design. If the quality is not justified and not foreseen in the project, it cannot be achieved in the production process. According to the volume of work performed and the target direction, projects for the production of products are divided into two categories [3, 4]:

1. Small short-term projects, such as traditional product's enhancements, that are introduced to fix production problems or resolve customer complaints.

2. Large projects such as new product design and contract projects that are commissioned by customers.

The processes of the quality management system at the stage of checking and analyzing the quality of products and services include: incoming control and testing, as well as quality control of raw materials, materials, semi-finished products in the processes of their storage and transportation; control of parameters of equipment, tooling, tools, devices, power supply systems, transportation and production environment; control over the condition of containers and packaging, the compliance of their parameters with the requirements of regulatory documents and contracts; design control and production supervision; control of compliance with technological discipline; systematic analysis of interdepartmental and external complaints, reasons for product returns or poor quality services; development of proposals to ensure and improve the quality of products and services [5].

The tasks of the stage of product quality control should ensure the implementation of the quality policy, as well as the general economic policy of the enterprise. Control is an integral part of the activity of any enterprise, a regulator of factors that form quality at all stages of the production process and ensure the release of high quality products. Only on the basis of comprehensive control can one rationally carry out production and produce high quality products that meet the requirements of consumers [5].

On the basis of experimental studies using materials with different properties, a list of factors influencing the quality of manufactured products was formed.

Below in **Table 1** the main parameters are listed that are recommended to be controlled for PVC plastic used for offset and silkscreen printing.

Table 1

PVC characteristics that are recommended to be monitored during the incoming inspection of the material

Product name	PVC white	PVC transparent
Application	For offset printing For silkscreen printing It is used for combined screen/offset printing	
	For plastic cards manufacturing by means of offset and silkscreen printing	
Chemical composition	–	
Surface	both sides matt	
Finishing	without coating	
Colour	Snow white	Transparent
Thickness range, mm	0.1±0.007 0.3±0.015	0.3±0.015
Sheets size, mm	a±0.5×b±0.5	a±0.5×b±0.5
Surface Tension for printing side, dynes/cm	40–42	
Surface Tension for non- printing side, dynes/cm	34–36	
Evenness of ink absorption	Absence of nonprinting areas after inks application	
Heat Shrinkage at 140 °C/10 min, % (MD – longitudinal, CD – diametric)	MD≥–4.5CD≤+2.0	
Vicat Softening Point B50 (5 kg), °C	74±2	
Surface roughness for printing side Ra, μm	0.5–1.8	
Tensile Strength, N/mm²	≥46	
Density, g/cm³	1.25–1.45	
Cutting direction	On a mm side	
Additional requirements	Sheet angles should be equal to 90°	
	If all the angles of the sheet are not equal to 90° there should be at least 1 correct angle equal to 90°. This correct angle should be marked and located at the same place for the whole inlay PVC pack	
	Absence of uneven edges of sheets cut	
	There should be no inequality, cavities, convexities	
	The sheets/reels should not contain any foreign inclusions like dust and dirt particles	

Parameter's control is carried out for each batch of materials. If the requirements are not met, these materials are not used in production [6–10].

The sample during inspection should be at least 0.1 % of the total amount of material, the deviation from the parameters should be included in the tolerances.

4. Discussion

It is important to note that with the improvement of incoming inspection in production, the percentage of plastic cards with defects is decreasing. Since in this work only PVC materials are considered for further research, it is planned to investigate the properties of other polymeric materials used to make cards, such as polystyrene and PET.

5. Conclusions

Based on analytical and experimental research:

1. Analyzed and summarized the parameters of the material, which are recommended to control during the incoming inspection of materials.

2. A table with parameters for PVC has been formed, which is used for printing plastic cards by offset, silkscreen and combined printing.

3. Due to the clear formulation of requirements for the production of materials, the possibility of manufacturing products is significantly reduced, which in the further production of the finished card will contain defects.

4. To control the parameters when receiving materials, it is recommended to use the following tools: measuring ruler, spectrophotometer, micrometer, extensometer, profilometer, square, indicator ink for measuring the surface tension of the surface of PVC sheets, heat chamber.

By improving the properties of materials, we are able to improve the durability of plastic cards and extend their useful life.

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