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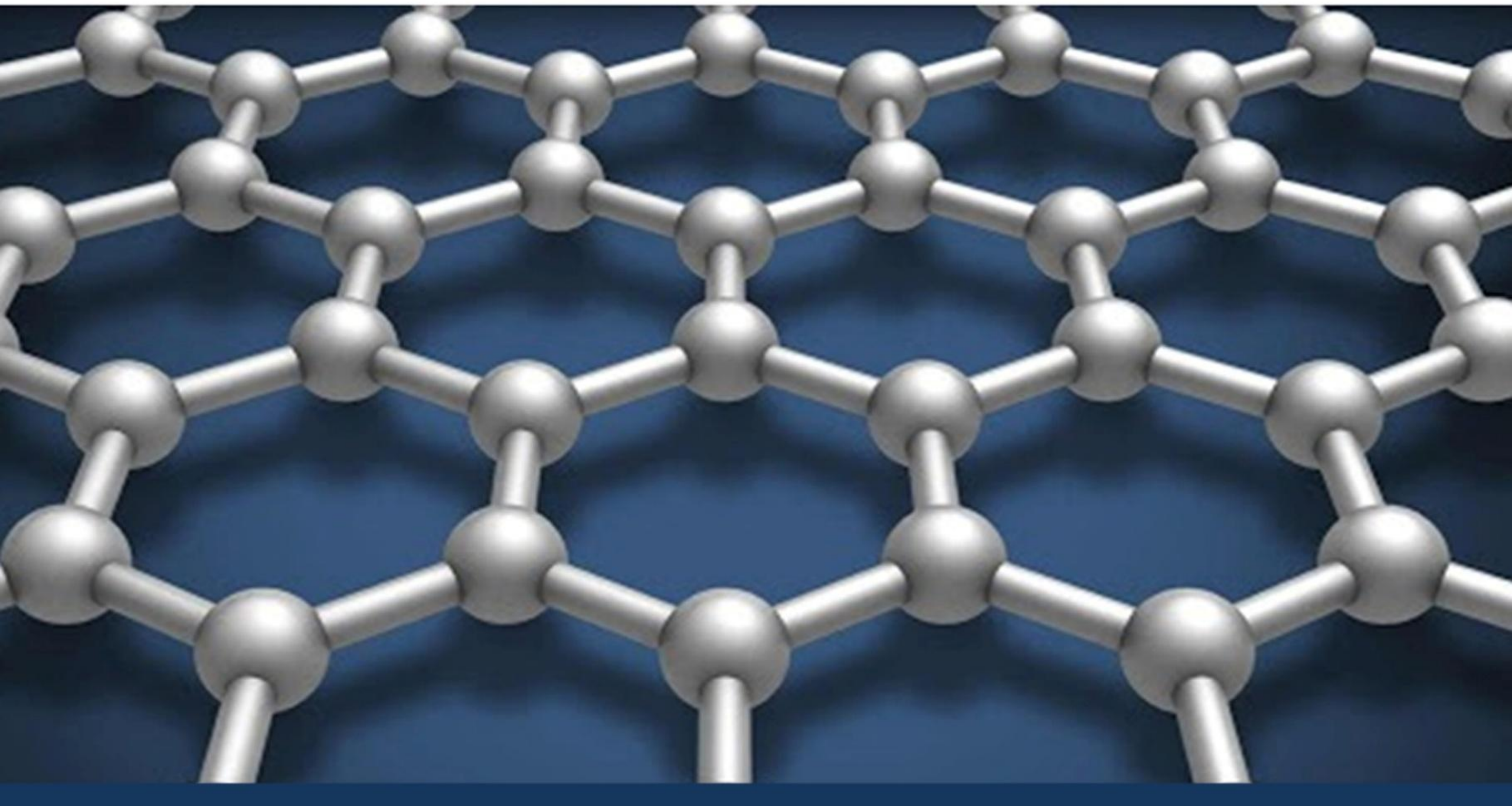
O‘zbekiston

Kompozitsion Materiallar

Ilmiy-texnikaviy va amaliy jurnali



Узбекский научно-технический и производственный журнал

Композиционные материалы

Таким образом, температура вспышки моторного масла - это критический параметр, который определяет качество, степень износа, пожаробезопасность и пригодность масла к дальнейшему использованию. Повышение этого показателя после очистки указывает на успешное восстановление эксплуатационных свойств масла.

Заключение. В рамках опытно-лабораторных испытаний на объектах АО «Узметкомбинат» испытывался композиционный деэмульгатор, разработанный на основе местного сырья. Результаты показали, что его применение снижает вязкость масла с 336,15 сСт до 216,9 сСт повышает температуру вспышки до 228 °C (в то время как исходное масло закипало при анализе), а содержание воды уменьшается с 42,4 % до 3,6 %. Эти показатели свидетельствуют о высокой эффективности деэмульгатора в разрушении эмульсии, удалении влаги и повышении термической устойчивости масла.

В связи с этим можно рекомендовать данной технологии, позволяющих получать химического композиционного деэмульгатора на основе местного и вторичного для широкого применения в процессе обезвоживания и очистки отработанных моторных масел в металлургической промышленности республики Узбекистан и сопредельных странах Центральной Азии.

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IMPROVING OPERATIONAL EFFICIENCY THROUGH THE ROBOTIZATION (AUTOMATION) OF THE TERMOPLAST 1300T WIZ MACHINE

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Abstract. This article addresses the issues of increasing production efficiency and organizing the manufacturing of high-quality products in the casting (injection molding) line at enterprises producing automotive lighting components. The study presents solutions for removing the robot from the thermoplastic machine, reinstalling it, adapting the electrical connectors (In/Out) to the machine, step-by-step programming of all robot movements using dedicated software (Windows), and commissioning the system by configuring a special gripper according to the product type.

Furthermore, the article includes photographs showing the conditions before and after robot installation, as well as an analysis of product quality improvements achieved through robot integration. In the previous condition, each time an operator entered the machine, fine dust particles from clothing could adhere to the product or mold, resulting in defective parts. By installing the robot, such contamination was prevented. Additionally, due to the reduced cycle time, timely injection of raw material by the screw was ensured, which eliminated various quality issues such as sink marks, deformation, streaks, and other common defects.

Keywords: Injection molding machine, cycle time, robot, efficiency, ensuring safety, First Time Quality (FTQ).

Introduction. Nowadays, robotic equipment and automation of production lines are widely applied in the automotive industry. Automating production systems provides numerous advantages and conveniences for both operators and end users. It is well known that the main customer of Uzchasys is UzAuto Motors, and the most demanded vehicle models in domestic and external automotive service markets are Onix, Tracker, and Cobalt. In order to deliver lighting components for these models on time, all processes (injection molding, coating, and assembly) were analyzed, and it was determined that the injection molding process represents the main bottleneck in terms of time consumption.

Within the injection molding line, the most time-consuming products are the semi-finished outer housing and lens components of the front lighting systems of these models, which are produced specifically on the 1300 WIZ machine. In order to increase production output, reduce the defect rate, ensure worker safety, and shorten production time, an in-depth study was conducted on this machine. Since the production of these parts is currently performed 100% manually, the required manufacturing time for each product was identified as follows:

1. Cobalt HL Housing – 115 sec;
2. Cobalt HL Lens – 95 sec;
3. Tracker HL Lens – 80 sec;
4. Onix HL Lens – 95 sec.

Typically, three methods are used in injection molding production:

1. Manual operation
2. Semi-automatic operation (Polyautomation)
3. Fully automatic operation (Automation)

Based on the above situation, in order to improve production efficiency, installing and programming a robot on this machine is expected to eliminate the listed shortcomings. In addition, the process requires comprehensive monitoring of all stages, starting from raw material feeding and hopper control. This includes ensuring that the dosing device supplies the specified amount of material from the main hopper to the secondary hopper in a timely manner, verifying that the screw tip heaters reach the set temperature, confirming that the hot runner control system connected to the mold is operating properly, and checking that the water circulation units connected to the machine function at the specified temperature. Furthermore, the operation of all moving axes of the mold during part ejection must also be monitored.

Below is a brief overview of the thermoplastic injection molding machine and the robot models used in such processes:

A thermoplastic injection molding machine (often abbreviated as TPA) heats and melts plastic raw materials (polyethylene, polypropylene, polycarbonate, etc.) and injects them into a mold under high pressure, resulting in the formation of a part with the required shape. Based on the machine designation, 1300 Ton WIZ indicates that the machine provides a clamping force of 1300 tons, keeping the mold tightly closed during injection. The term WIZ represents the model designation assigned by the manufacturer of the thermoplastic machine. In addition, other variants such as WIZ-T and WIZ-VR are also available.

Injection molding robots typically have 3 to 6 axes, depending on the product type and production requirements. The most commonly used robot brands include Nexia (HY Robotics), Engel Viper, Sepro, Yaskawa, ABB, and KUKA. These robots are mainly manufactured in Germany, the USA, Korea, Japan, and China.

Research Objects and Methods. During the study, the following methods were applied:

Analytical analysis: The working time of the existing robot was calculated, and the installation of the robot onto the new machine was theoretically assessed through relevant calculations.

Computer modeling: Using AutoCAD software, the robot mounting positions were determined by aligning them with the installation points of the thermoplastic injection molding machine and defining special fixing holes. The prepared technical layout was then provided to the maintenance department for practical drilling and installation works (Figure 1).

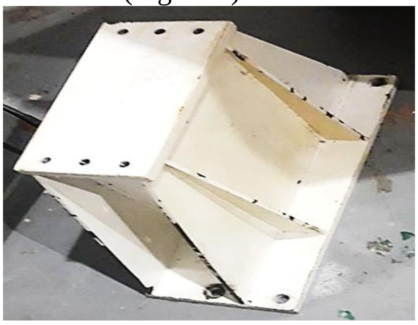

Figure 1. Special fixture for installing the robot onto the machine

Using a special fixture, mounting holes were created on the thermoplastic injection molding machine for the robot installation. The robot was then installed and its movements along the X, Y, and Z axes were tested (Figure 2).

Figure 2. Process of installing the robot onto the machine using the prepared fixture

This methodological approach contributes to accelerating production output in the injection molding line.

Results. Based on the research and practical implementation results, the installed robot provided the following advantages in production: The production time of the following parts manufactured on this injection molding machine was reduced (Table 1).

Table 1.

Production time of parts manufactured on the injection machine

№	Name	Cycle time		Time reduction difference
		Before	**After**	
1	Cobalt HL Housing	115	110	-5
2	Cobalt HL Lens	95	90	-5
3	Tracker HL Lens	80	75	-5
4	Onix HL Lens	95	90	-5

Regarding the safety of the operator working on the machine, before the robot installation, the operator had to enter the machine each time to manually remove the part. During this process, there was a risk of the operator falling onto the tie bars and sustaining bodily injuries. After the robot was installed, the operator no longer needs to enter the machine, and the risk of falling has been eliminated (Figure 3).

Figure 3. Operator's condition before robot installation and the operator's actions after the robot was installed

The number of defective parts generated during production was reduced. Previously, when the operator entered the machine, fine dust particles from the operator's clothing could adhere to the mold surface, and during injection molding this contamination could cause product defects. After the robot was installed, the operator no longer needs to enter the machine, which prevents dust contamination. As a result, the monthly quality indicator, namely the First Time Quality (FTQ) rate, improved and is presented as follows (Table 2):

Table 2.

Number of nonconforming products before robot installation and after robot installation, and the First Time Quality (FTQ) indicator

№	Name	Side	Report of December		
			FTQ%		**FTQ%**
1	4NB Head Lamp Housing	LH	97%	→	99%
		RH	94%		99%
2	4NB Head Lamp Lens	LH	87%		96%
		RH	91%		98%
3	JBUC Head Lamp Lens	LH	93%		93%
		RH	93%		96%
4	JBSC Head Lamp Lens	LH	86%		96%
		RH	80%		94%

Discussion. The results of the study presented above demonstrate that installing a robot on the injection molding machine improves production quality indicators and provides more convenient and safer working conditions for operators. Prior to robot installation, the production output during one shift was 344 sets (LH, RH). As a result of the implemented improvements, production increased to 360 sets (LH, RH) per shift. Based on these calculations, this improvement corresponds to an additional output of 32 sets per day, 960 sets (LH, RH) per month, and 11,520 sets (LH, RH) per year.

Conclusion. In conclusion, the key significance of the implemented solution is that producing a higher volume of products compared to the planned target leads to a reduction in unit production cost. Furthermore, it increases the competitiveness of these products in the market and provides clear economic benefits for the manufacturing enterprise.

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