

Analysis of flexographic printing technologies and machines in the production of packaging materials

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Annotation: The article analyzes the essence, brief history, meaning, technology, designs of used machines, directions and prospects for the development of flexographic printing, and identifies the advantages and disadvantages of machines for flexographic printing. In addition, ways to eliminate shortcomings are described and directions for research work to improve this technology and machine are established.

Keywords: flexographic printing, flexographic technology, flexographic machine, material, paint, polymer film, bubble film.

Flexography is a type of printing that uses an elastic stamp and a low-viscosity ink. Flexographic machines were originally designed to stamp packaging materials from scratch, and there is no limit to the types of material that can be printed. Usually, the material is selected based on the technological process. Materials can be paper, cardboard of optional appearance (special layer coated, laminated, etc.), self-adhesive materials, metal foil, polymer films of optional type and thickness, non-standard materials (material with a rough surface, for example, fabric).

Flexible photopolymer stamps are used for flexographic printing. Such stamps have a number of undoubted advantages compared to those used in other types of printing. They include simplicity in preparation, resistance to printing. The durability of the photopolymer stamp is 1 - 2.5 million impressions more than the durability of the ordinary monometallic offset printing die. The elasticity of the stamp eliminates corrections in the printing process and allows stamping on rougher materials. In the offset method, it is not possible to press on coarse materials at all.

In flexography, in addition to flexibility, there is another advantage when choosing a stamp material, and that is its cost. Photopolymer stamps are much cheaper than metal stamps, which is only one of the reasons for the relative low cost of flexographic printing, because placing a flexographic machine in line with laminating, cutting, folding and gluing equipment is more economical and efficient than printing machines with other separate technological processes. A typical flexographic machine can stamp, cut, punch, pack, and glue plastic sheets in one process cycle. That's why flexographic printing is called packaging materials makers.

One of the unique aspects of flexography is the possibility of placing stamps of different sizes in different forms, which ensures economical use of material, while offset stamps have fixed dimensions and the percentage of waste increases. While offset lithography is oil-based, the ability of flexographic machines to work with water-based inks becomes a decisive factor in stamping on packaging materials for food packaging. It is usually acceptable to use water-based paints from an environmental point of view. Therefore, the use of water-based paints in the preparation of food packaging materials is determined by the state standard.

It can be said that the beginning of full-fledged flexographic technologies dates back to the 80s of the last century, with the development of new printing machines, new materials and paints. DuPont, Zecher and Windmueller & Huelscher have flexographically printed display images at DRUPA - 82. Flexography as an independent printing method appeared in 1990 at DRUPA - 90. Since then, the flexographic method began to develop rapidly. Mechanical engineering, electronics, automation, chemistry has become a highly industrialized method that uses modern achievements of other sciences and industries [1-8].

In recent times, the role of flexographic printing in the preparation of packaging materials has been significantly increased. In 1995, flexography took a leading position in the production of packaging materials in Europe.

Recently, the production of packaging materials by the offset method has fallen into a difficult situation: production numbers have decreased, and the tradition of increasing customer demands has been affected. The customer demands that the product be of high quality and ready in a short period of time.

In the next decade, the flexographic method was used in the production of bags and boxes in Uzbekistan. But the rate of development is significantly lower than that of developed countries. For example, the production of labeling and packaging products in the USA reaches 85%, in Western European countries - up to 50%. According to experts' predictions, by 2030 in Uzbekistan, preparation by this method may make up 25-30% of printed packaging materials. Flexographic printing is widely used for printing the brand name, operational information about the manufacturer, production time, etc. on different types of labels, packaging, adhesive paper and polymer materials.

Thus, flexographic printing is currently the dominant printing method for the preparation of various packaging materials with different functions. Due to its cost-effectiveness and universality of use, the flexographic printing method is approaching the offset printing method in terms of application. Later, the development of photopolymer stamps made the flexographic printing method competitive in terms of print quality.

Compared to offset printing machines, flexographic machines have significantly less pressure in the printing pair, so they use less material and energy.

Offset pressure due to planetary positioning Due to its compactness, it takes up less space than a machines. It has high efficiency in the production of interchangeable sleeves with a photopolymer brand and requires less space for storing cylinders. All this provides a great cost-effectiveness of the flexographic printing method.

All flexographic machines are conditionally divided into two groups: narrow roll and wide printing machines. There are also special sheet machines, which are mainly used for stamping on corrugated cardboard and other thick packaging materials. In traditional flexographic presses, the roll width is 600 mm, and the structure is usually planetary or aggregate type. Machines of this type have a high speed, but the operability of moving from one item to another is very small and is designed for very large numbers. Their sizes are very large and service is complex and requires large financial costs.

The structure of the paint apparatus of an optional printing machine depends primarily on the properties of the paint used. In flexography, liquid paints with a viscosity close to that of water are used. This makes it possible to abandon the system of 10 to 20 printing layers needed to obtain a thin layer of paint in offset printing. The flexographic paint apparatus consists of three units in total. a rubber-coated die that rotates inside the paint container transfers the paint to a steel or ceramic die with very small pits on its surface. Such yarn is called raster or anilox yarn. Excess paint is scraped from its surface with a squeegee type knife. The standardized ink on the anilox roller is then transferred to the stamp mounted on the printing cylinder, after which the ink is transferred to the material to be printed. Since the thickness of the paint layer can be precisely adjusted, there is no need for regional adjustment of the paint thickness and it greatly simplifies the process of adjusting the number. Since the distance between the printing stamp and the stamp gap is large, the wetting process is eliminated in the apparatus. This situation makes the construction of the machine very cheap and makes it possible to adjust the number in a short time.

To obtain high-quality labels, polypropylene films with a thickness of 30 μm and a weight of 28 g/cm^2 (colorless, metallized, bright and "twist" effective) and recyclable "Polysyper" foils are widely used.

Polypropylene film is a unique material with technical and operational characteristics. Its main advantage is the possibility of high-quality printing, ease of welding or gluing, and long-term storage of the packaged product [13-22].

The analysis of scientific, technical and economic sources revealed that flexographic printing has a number of advantages and disadvantages compared to other types of printing.

The main advantages of flexography:

- Size of coverage of printed materials;
- Ability to press on very thick materials;

- Relative economy of numbers in the ken range;
- Flexibility of stamps of different sizes;
- Ability to use water-based paints;
- Ability to combine post-press processes (lamination, trimming, folding and gluing) into one line.

The main disadvantages of flexography:

- The magnitude of the stamp pressing force;
- Difficulty of reproduction in conditions of shade and strong light;
- Difficulty printing small letters, especially inverted letters;
- Low efficiency in small quantities;
- Changes in print quality when switching from machine to machine;
- Lack of industry standards;

In this case, pre-printing and post-printing processes are eliminated by improving hardware and software complexes.

The technologies and machines mentioned above are designed to print the necessary information on flat and smooth materials. Trademarks and other information on bubble wrap are not considered. In order to solve this problem, the scientists of the "Technological machines and equipment" department of the Namangan Engineering-Construction Institute executed a contract on this issue and made a device that performs this task.

The created device differs in that it is much simpler and cheaper than existing machines. Currently, scientific research is being conducted in this direction, and a new type of paint apparatus has been invented and an application for a patent has been filed.

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