Proceedings of the International Symposium of Mechanism and Machine Science, 2017
AzC IFToMM – Azerbaijan Technical University
11-14 September 2017, Baku, Azerbaijan

Influence microgeometry offset printing plates for transfer ink from the printing form on dekel

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Abstract:
This article is devoted to the study of the influence of the roughness of the surface shape in the paint transfer in the area of contact-form blanket. Given the impact of the space layer forms a rough surface on the amount of paint on the surface shape investigated form paint transfer blanket on the contact zone. The obtained formulas it can be concluded that the surface roughness of the printing plate has a significant impact on the amount of ink to print, the separation factor of the ink layer and transfer ink from the printing plate on the blanket in the contact zone.
Keywords: offset printing, contact area, roughness, blanket, the amount of ink, paint transfer.

1. Introduction

For any number of copies printed during the printing ink transfer from the inking unit on the printing plate and printing material to form. A recording apparatus, one of the main components of the printing machine, consists of a feed device, and dispensing and applying the ink on the printing plate, and also working elements performing a printing process [1-3]. The printing apparatus also consists of a carrier of the printing form and apparatus for producing pressure.

Rotary printing machines have a cylindrical printing plates and cylindrical pressure device. A recording apparatus for transferring ink from a certain number of printing elements to form the printed material with sufficient surface pressure and wiring of the printed material through a printing zone. Actions associated with the printing units of the printing plate and a view type of printed material is shown in [1, 2].

Transmission of information from the printing plate to the material can occur directly or indirectly. In indirect method, the ink is transferred onto the elastic intermediate surface and from it - to a printing material [1-4].

Indirect transfer with ink in offset printing is carried out in two stages. As indicated in [2], located on the print ink layer comes into contact with the rubber-plate (with deckle) of the blanket cylinder. In this part the layer remains on the wafer surface and the paint in contact with it deckle o

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However, as noted by the authors of [2-4], the adhesive forces that act between the ink and the printing form, deckle blanket cylinder and the impression material are always less than the cohesive forces acting in the printing ink. The above makes it possible to paint the required separation into layers.

2. Calculation scheme for transfer ink.

It is known that the printing elements and looseness on offset printing plate lie substantially in one plane. There are two contact zones in offset printing, so the two factors separating the ink layer (Fig. 1) is defined for them.

The first zone: printing form - offset plate (deckle)

$$v = \frac{m_i}{m - m_i}, \tag{1}$$

second zone : offset plate - printed material

$$v_i = \frac{p}{m_i - p}. \tag{2}$$

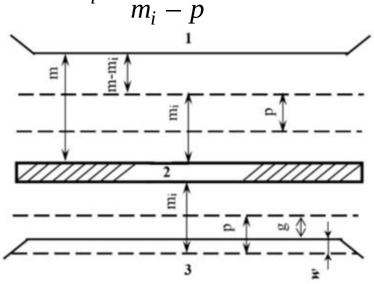

Fig. 1. Scheme of separation of paint layer in the indirect printing method

1 - printed form; 2 - offset rubber plate; 3 - paper; m - number of colors on the printed form before printing ; p - the amount of ink which has passed to the printed material; m_i - the amount of paint on the lid of the blanket cylinder before moving on to the printing material ; g - the number of colors, freely lying on the material ; w - quantity paint , absorbent printing material during the printing process.

An ink transfer from plate to rubber- plate (on deckle) basically corresponds to printing on non-absorbent material. The study results [2] show that the coat of paint which remains on the plate blanket cylinder (by deckle), is not directly involved in the division of the working layers of paint, so it can be ignored.

According to [2] transfer the ink from the printing plate to the plate of the blanket cylinder (deckle on) is

$$m_i = \alpha m\left(1 - e^{-\alpha^2 m^2}\right). \quad (3)$$

Transfer the paint from offset plate (with dressing) onto the printing material is

$$p = \left(1 - e^{-\alpha_i^2 m_i^2}\right)\left[(1-\alpha_i)w_{max}\left(1 - e^{-\frac{m_2}{w_{max}}}\right) + \alpha_i \cdot m_i\right] \quad (4)$$

where w_{max} -the maximum possible amount of paint , q/m^2;

α, α_i - coefficients of the partition paint layer

$$\alpha = \frac{g}{m-w}; \quad \alpha_i = \frac{g}{m_i - w}. \quad (5)$$

3. Influence microgeometry of printing form for transfer ink.

As seen from the calculation scheme when determining the amount of ink on the printing form before printing, as well as calculating the amount of ink on the lid of the blanket cylinder (to the deckle) is not considered microgeometry printing plate surface. To determine the amount of the paint layer based microgeometry printing plate surface, the ink layer separation circuit indirect printing process can be represented as follows (Fig. 2).

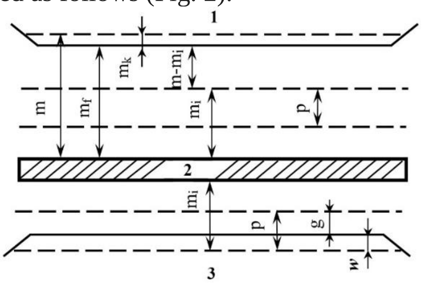

Fig.2 . Driving separation layer of paint indirect printing method taking into account the printing plate surface microgeometry

The new scheme of separation of the paint layer in the indirect method of printing is different from the existing schemes m_f parameters - amount of paint freely lying on the surface of the printing plate and m_k - the amount of ink on the rough area of the printing plate surface. Given these parameters, the amount of ink on the printing plate before printing define as follows

$$m = m_f + m_k. \quad (6)$$

Considering the formula (6), the formula (1) and (3) can be written as

$$v = \frac{m_i}{(m_f + m_k) - m_i}. \quad (7)$$

$$m_i = \alpha(m_f + m_k)\left(1 - e^{-\alpha^2 (m_f + m_k)^2}\right) \quad (8)$$

Partition coefficient layer of paint is:

$$\alpha = \frac{g}{(m_f + m_k) - w}. \quad (9)$$

As the authors note 2, the transfer of ink by dividing the paint layer is influenced by:

- Thickness of the paint layer on a printed form,
- The duration of the contact printing, which is determined by the printing speed and the construction of the printing apparatus,
- Specific pressure in printing,
- The rheological properties of the ink,
- Temperature and humidity conditions in the pressroom, which influences the rheological properties of the ink,
- The nature of the surface of the printed material.

Given that the offset printing ink layer separation occurs in the contact zone, the amount of ink to form useful to define a zone of contact with the printing plate blanket. Number of colors in print form the rough surface area can be calculated by the formula

$$m_k = \rho V_k, \quad (10)$$

where ρ – specific ink weight, v_k – ink amount space in the rough surface of the printing plate .

To determine the amount of ink on the print subject microgeometry printing plate surface using the calculation scheme proposed by the authors [5] .

Under this scheme, the amount of space of rough surface occupied paint, based on the formula I.V. Kragelskii [6], is defined by :

$$V_k = \frac{\pi R_1 \cdot L}{360^0}\gamma\left[R_{max}\left(1 - \frac{R_{max}}{R_1}\right) - 2R_a\right], \quad (11)$$

where R_1 – the radius of the cylinder shaped to fit the shape thickness, L–the length of the contact zone, γ – angle arc of wrap contact, R_{max} – the maximum height of unevenness of the printing plate surface, R_a – the arithmetic average height of the unevenness of the printing plate surface.

In view of formula (11), the formula (10) can be written as:

$$m_k = \frac{\rho \pi R_1 \cdot L}{360^0}\gamma\left[R_{max}\left(1-\frac{R_{max}}{R_1}\right)-2R_a\right], \quad (12)$$

Given (12), formulas (6÷9), can be written in the following forms:

$$m = m_f + \frac{\rho \pi R_1 \cdot L}{360^0}\gamma\left[R_{max}\left(1-\frac{R_{max}}{R_1}\right)-2R_a\right] \quad (13)$$

$$v = \frac{m_i}{(m_f - m_i) + \frac{\rho \pi R_1 \cdot L}{360^0}\gamma\left[R_{max}\left(1-\frac{R_{max}}{R_1}\right)-2R_a\right]} \quad (14)$$

$$m_i = \alpha\left\{m_f + \frac{\rho \pi R_1 \cdot L}{360^0}\gamma\left[R_{max}\left(1-\frac{R_{max}}{R_1}\right)-2R_a\right]\right\}\times$$

$$\times\left(1-e^{-\alpha^2\left\{m_f+\frac{\rho\pi R_1\cdot L}{360^0}\gamma\left[R_{max}\left(1-\frac{R_{max}}{R_1}\right)-2R_a\right]\right\}}\right) \quad (15)$$

$$\alpha = \frac{g}{(m_f - w) + \frac{\rho \pi R_1 \cdot L}{360^0}\gamma\left[R_{max}\left(1-\frac{R_{max}}{R_1}\right)-2R_a\right]} \quad (16)$$

To determine the effect of surface roughness on printed form ink amount on the mold surface must carry out experimental studies.

4. Methods of research.

To determine the amount of print on ink gravimetric method was used [2,7]. This calculated difference between the masses of the printing plate with thumb paint and printing plate without ink. For this used proofing apparatus and analytical balances, whom error is ± 0.00001 g

For preparing the samples used in the printed form of the brand PRO-V company Fujifilm, which composes the dimensions 530×700 mm. The radius of the cylinder shaped 107 mm; the proportion of offset inks ρ=1,5 g/sm^3.

Using formula (13) theoretically calculated quantity paint on the printing plate surface.

The results of theoretical and experimental data are shown in Table 1.

Table 1. The dependence of the quantity of paint on the surface roughness of printing shape of the mold surface

Roughness parameters surface printing plate microns, mkm		The amount of paint on surface shapes, m, g	
R_{max}	R_a	theoretical	experimental
2,25	0,45	26,2945	27,6092
3,2	0,64	26,3133	27,6290
4,36	0,83	26,3390	27,6560
4,36	1,02	26,3595	27,6775
6,3	1,2	26,3687	27,6871

Number of colors on the printed form surface certain by calculated without taking into account the roughness of the surface shape is mp = 26.2511 g Comparison of the results obtained experimentally and theoretical ways showed the influence of roughness surface forms on the amount of ink on the form.

5. Conclusion.

As seen from the above formulas the amount of ink on the printing form before printing, the separation factor of the paint layer as, ink transfer the from the printing plate on the blanket depends on the radius of shaped cylinder and the contact area length, also, as was investigated and inserted the wrap angle arc of contact, and the parameters of microgeometry printing plate surface.

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