Contemporary Engineering Sciences, Vol. 7, 2014, no. 36, 1943 - 1947
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http://dx.doi.org/10.12988/ces.2014.411243

Maintenance of Quality of Paint and Varnish Coverings of Building Products and Designs

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Abstract

Details on the use of statistical methods of quality control to the analysis of the process of obtaining coatings with desired properties are listed in this article.

Keywords: surface roughness, paint coating, the defect level

Introduction

Practice shows that the projected service life paint coatings of building products and structures, is 5-6 years, not always confirmed. The destruction of coatings often observed after 2-3 years of operation. In this connection very urgent is to develop methods to improve the quality of paint coatings. Earlier results of studies have established the connection resistance paint coatings with the quality of their appearance [1]. Analysis of domestic and foreign literature shows that issues of coating application on porous cementitious substrates have not yet been properly developed. Cement substrate is characterized by uneven distribution of pores along the strike of the surface, which affects the formation of the quality of the appearance of the coating. The formation of coating quality appearance also influence the rheological properties of the ink, its method of application, etc [2].

In order to ensure the quality of the appearance of the coating offers the following approach. Based on the structural and probabilistic analysis scheme is considered the production of coatings for each application method: paint with specific rheological properties as a coloring → quality cement substrate →decorative coating.

Below are the results of the statistical analysis of experimental data of research on the impact of the cement porosity of the substrate on the surface roughness of the coatings

The methodology of the experiment

The colorful compositions were coated pneumatically cementitious substrate porosity of 24%, 28%, 32% in two layers with intermediate drying for 20 minutes. The rheological properties of paints were evaluated in terms of their dynamic viscosity. In this paper we used the following colorful compositions: alkyd enamel brand PF-115, oil paint brand MA-15. Paint PF-115 had dynamic viscosity η_1 = 0,001 Pa·s, paint MA-15 - η_1 = 0,0026 Pa·s. The surface roughness of the coating was determined using profiler brand TR100. Totally we have performed 50 measurements on each surface of the circuit shown in Fig. 1.

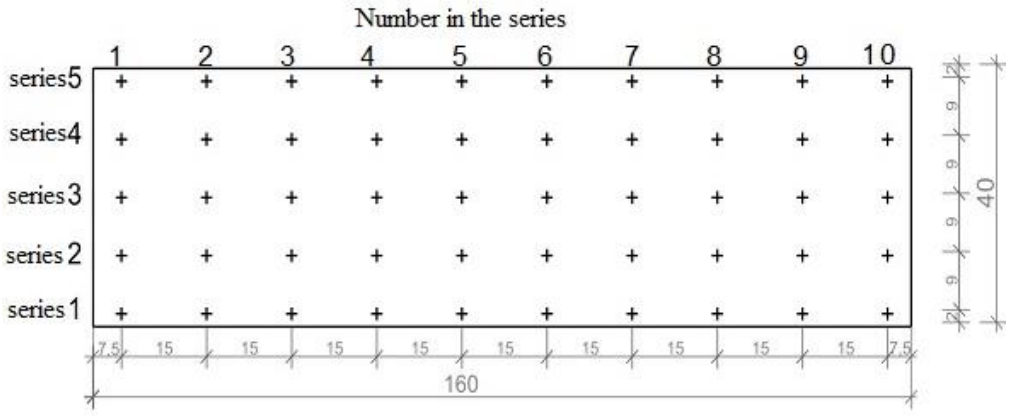

Fig. 1. Scheme of the measurement of surface roughness paint coatings on cement substrate (all dimensions in mm)

Results of experiment

The experimental results and statistical processing are shown in tabl.1, 2

Table 1
Statistics of sample

Kind of a paint	Porosity of a substrate, %	Roughness, R_a micron	Standard deviation (σ),/ the range of data (R)
PF-115	24	6,7	2,88
			10,94
	28	7,65	1,92
			8,61
	32	6,98	3,32
			11,21
	putty	2,6	0,95
			3,68
MA-15	24	4,37	2,94
			10,12
	28	4,53	2,6
			10,31
	32	5,4	5,61
			10,1
	putty	2,8	1,21

Analysis of the experimental data shows that the meaning the surface roughness R_a of the coating depends on the type of ink composition and the porosity of the cement substrate. Thus, for oil-based paint MA-15 (green color), the minimum value of surface roughness R_a = 4,37 mkm achieved on a substrate having a porosity P = 24% and a maximum of R_a = 6,7 mkm - if P = porosity of 32%. For PF-115 paint minimum roughness value Ra = 6,7 mkm achieved on a substrate having a porosity P = 24%. When applying paints to the surface the coating puttied with a minimum surface roughness formed. For coatings based paints PF-115 and MA-15 roughness R_a = 2,6 mkm constitute and R_a = 2,8mkm. For a more accurate evaluation of the distribution of roughness on the surface was carried out statistical processing.

Analysis of the data presented in Table 1 shows that regardless of the type of paint, the porosity of the substrate, there is a heterogeneous distribution of roughness. Thus, when applied to a substrate PF -115 with a porosity of 24% span is 10,94 R m and paints MA-15 - 10,12 mkm. Swipe between roughness Ra surface coatings based paint PF-115 on the plastered surface is much lower and is 3,68 mkm. For PF-115 dye less uniform coating is formed on the strike when applied to a substrate with a porosity of 32%. Spread roughness R_a of R_a = 11,21 mkm. Regardless of the type of paint smaller roughness Ra variation is typical for coatings on the filler substrate.

Taking into account that the tolerance surface roughness coatings are distributed

according to the normal law, we can obtain the value of the defect level q by the formula

$$q = 0{,}5 - \Phi\left(\frac{B\Gamma - \overline{R}}{\sigma}\right)$$

where Φ - function of Laplace;

σ - standard deviation;

BΓ - upper limit of the tolerance

$\overline{R}$ - the average value of surface roughness

We have calculated defect level coatings for surface roughness classes N4 and N5 according to ISO1302 (Class N4 roughness BΓ is 8 mkm, for N5 -16 mkm). The results of the calculation are given in Table 2

Table 2
Level of deficiency of coverings

Kind of a paint	Porosity of a substrate, %	Level of deficiency, %, at a class of a roughness	
		N4	N5
PF-115	24	32,64	0,069
	28	36,84	0,103
	32	38,21	0,33
	putty	0,001	0,001
MA-15	24	10,93	0,007
	28	12,34	0,012
	32	32,38	3,01
	putty	0,006	0,001

Found that coatings based paints PF-115 and MA-15, measured roughness class N4, have a high defect rate (to 38%) and the roughness class N5 - 0,007-3,01% max. Regardless of the type of paint, the porosity of the substrate surface before painting putty promotes formation of coatings with a low level of defects, constituting 0,001-0,006%.

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Conclusion

Thus, in order to increase the resistance of coatings to be considered porosity cement substrate.

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Received: December 5, 2014; Published: December 29, 2014