Journal of Engineering and Applied Sciences 11 (11): 2409-2410, 2016
ISSN: 1816-949X

The Method to Estimate the Surface Appearance Quality of the Paint Applied to the Cement

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Abstract: It is proposed to estimate the coating surface quality with the fractal dimension index. The method of the fractal dimension estimation is shown. The correspondence between the coating appearance quality and the fractal dimension index has been found.

Key words: Coating, appearance, surface profile, fractal dimension, Russia

INTRODUCTION

The paint work surface quality is determined, among other things, by its roughness, i.e., surface profile (Loganina, 2014a-c). When estimating the coating surface profile, methods of the fractal physics can be applied. The fractal dimension index D of the coating surface profile is ranged between 1<D<2. The greater the roughness of the coating, the more curved coating profile is and the greater the value D is. Thus, the fractal dimension D of the coating profile can serve as a criterion of its appearance quality, reflecting the presence of inclusions, streaks, waviness (Loganina, 2015)

MATERIALS AND METHODS

We have attempted to evaluate the possibility of describing the coating surface quality using fractal dimension. The paints were applied with a brush ontoa mortar substrate in two layers with a 24 h intermediate drying. The coating profile wasdetermined with a profilometer A1. The length of the coating surface profile was determined with a perambulator.

In addition, the coating surface quality was estimated with a gloss meter FB-2. The fractal dimension D of the coating surface profile was estimated by the geometrical method. For this purpose, the image of the curve obtained by using a profilometer profilograf was covered by a grid consisting of squares with side L1. Then, the number of the squares N which curve N (L1) went through was counted. Changing the gridscale, we each time re-counted the number of the squares intersecting curve N (L2), N (L3), N (Ln). Then, in log-log gridwe plotted N (L), according the inclination angle of which we determined the fractal dimension.

RESULTS AND DISCUSSION

Table 1 shows the results of the coating surface quality estimation which was carried out in accordance with GOST 9.407-74 and by using the fractal dimension of the coating surface profile.

As it is seen, between the coating surface roughness, the appearance quality class and fractal dimension there is a correlation. As the surface roughness increases the appearance quality class decreases and the fractal dimension D increases.

For example, the coating surface profile fractal dimension based on PF-115 with a coating surface roughness and the appearance quality class, respectively 0.2 m and Y is D = 1.17 while with the coating surface roughness and the appearance quality class, respectively, 0.75 μ and YI-D = 1.35. The similar patterns are typical for other types of the coatings.

The change in gloss and the coating surface profile parameters on the sample length equal to 10 cm also prove the fact. When the coating surface profile fractal dimension increases, the gloss decreases and the numerical values of the profile perimeter increase.

The correlation between the length L of the coating surface profile on the sample length 1 and the fractal dimension D can be approximated as:

$$L = lD^{bD} \quad (1)$$

where, "b" a constant factor In particular, for the coatings based on paint PF-115 the expression (Eq. 1) is:

$$L = 99.62D^{0.33D}$$

For paint MA-15 based coating:

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Table 1: The coating appearance quality estimation

The paint	The coating surface roughness (Ra, mkm)	Fractal dimension (D)	The surface profile perimeter (mm)	The coating surface quality kind	Gloss (%)
PF-115	0.22	1.170	106.000	Y	70.8
	0.75	1.350	116.000	YI	67.7
MA-15	0.20	1.075	102.000	Y	83.1
	0.48	1.125	109.000	YI	78.0
NC-123	0.20	1.100	105.000	Y	76.9
	0.75	1.360	121.000	YI	67.7
Acril.Universal	0.75	1.300	216.000	YI	66.2
	1.26	1.420	221.000	YII	642.0
Water-dispersible facade	0.60	1.250	192.000	YI	66.2
	1.24	1.700	225.000	YII	62.2

$$L = 99.08D^{0.638D}$$

For paint NC based coatings:

$$L = 99.55D^{0.416D}$$

For acrylic paint based coating:

$$L = 115.28D^{1.47D}$$

For water-dispersible façade paint based coatings:

$$L = 131D^{0.645D}$$

The results of the research suggest that the fractal dimension D, equal to D = 1-1.09-IY, D = 1.1-1.2 the coating appearance quality class is Y, when D = 1.21-1.4 YI, D = 1.41-1.99 -YII.

CONCLUSION

Applying the integral performance index to the coatings appearance fractal dimensions will let estimate paint coatings quality more objectively.

REFERENCES

Loganina, V.I., 2014a. Economic estimation of quality process of coloring building products and designs. Contemp. Eng. Sci., 8: 71-75.

Loganina, V.I., 2014b. Model for predicting protective and decorative exterior walls. Contem. Eng. Sci., 8: 77-84.

Loganina, V.I., 2014c. Maintenance of quality of paint and varnish coverings of building products and designs. Contemp. Eng. Sci., 7: 1943-1947.

Loganina, V.I., 2015. The estimation of reliability of protective: Decorative coverings. Contemp. Eng. Sci., 8: 91-95.