Increase in stability of paints modified with fullerenol-d

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In [1] we described a comparatively cheap method for the production of water-soluble fullerene derivatives – fullerenols-d ("direct") – FL-d. In the concept of the FL we included not only the derivatives $C_n(OH)_X$ (n = 60, 70, etc.) but also a mix containing $C_n(OH)_XO_Y$, $[C_n(OH)_XO_Y](ONa)_Z$, i.e. not hydroxyl groups and groups of salt type.

The presence of a good number of functional groups, high water solubility and low production cost justify the research for FL-d in such mass applications as water-soluble paints and modifiers of metallic surfaces exposed to corrosion. The FL-d solubility research in water has shown that this solubility is high enough for the introduction of the FL-d in many water-soluble grounds-enamels without any artificial heating. Besides that, already at 50°C the solubility of FL-d exceeds that of such highly soluble salt as halite.

We have chosen a red-brown water-based anticorrosive acrylate ground-enamel VAK VD–AK–012PK (VAPA, Ltd., St.-Petersburg, Russia) for ferrous metals as a paint.

When adding as small quantities of FL-d as $2.5 \cdot 10^{-4}$ M (Mol of FL-d/l) the stability of the covering increased significantly to reach 7 rel. % for the removal of the first 5 microns and 25 rel.% for total removal of the paint. With the further increase in the fullerenol-d content the stability increased catastrophically: 8.3 times for the initial resistance and 2.9 times for the total removal resistance. In other words, the fullerenol-d (added to the paint in sufficient quantity) sharply increases the abrasion resistance of the covering, the greatest increase being observed for the external (i.e., the initially attacked) surface. This fact is even more important for practice than an integral abrasion resistance.

The same proportions of the FL-d reduce the adhesion instability determined by standard test run methods, by 29% and down to zero level, respectively.

[1] http://www.ioffe.ru/ACN/2011/ K. Semenov, N.I. Alekseyev, N. Charykov, V. Keskinov. Cheap Method for Synthesis of Highly Water Soluble Fullerene Derivatives-Fullerenols-d.