

Anti-corrosion properties of metallic surfaces 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. Because of a specificity of our method, which does not provide total removal of sodium from the system in practically adoptable situations, we widened the concept of FL-d. We included in FL-d not the derivatives $C_n(OH)_x$ ($n = 60, 70, \text{etc.}$) only 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 the 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 research for anticorrosive properties of FL-d was started with the question whether small quantities of FL in an active environment catalyze corrosion or inhibit it. We used a water solution of H_2SO_4 with a normal concentration of $N(H_2SO_4)=0.25$ g-equivalent/l as a reference solution. In this environment the FL-d showed itself as not an inhibitor but as a rather weak catalyst of corrosion. Even its as negligible quantities in this environment as $5.01 \cdot 10^{-5}$ M(mol/l) accelerate the corrosion processes on the both steel (~5 rel.%) and aluminum surfaces, at least within the first 1-2 hours.

On the contrary, for the metals, preliminarily treated with the FL-d, the result was positive. We treated the samples through their soaking in 0.0044 M water solution of FL for 3 days at RT. The measurements show the corrosion rate reduces by the factor of ~9, i.e. the FL-d suppresses the corrosion. What is more, the suppression is revealed most of all in the first moment of the contact with an electrolyte. The technical aluminum showed similar results.

The corrosion reduction in water solution, stimulated by FL, is natural to correlate with higher insulating characteristics on proper metallic borders. In the case of steel the surface resistance increases ~10 orders of magnitude. This fact is connected with the formation of FL semiconducting film. A similar result is registered for aluminum.

- [1] [http://www.ioffe.ru/ACN/2011/K.Semenov, N.I.Alekseyev,N.Charykov, V. Keskinov.](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.