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Spectral analysis method of electrical signals in applying for stainless steel's surface estimation during corrosion monitoring

© **Anna N. Akhmetova**,[1+] **Svetlana S. Vinogradova**,[1]* **Ramilya F. Tazieva**,[2]
Nikolay B. Berezin,[1] and **Vladislav A. Sysoev**[3]
[1] *Department of Electrochemical Engineering.* [2] *Department of Information Science and Applied Mathematics.*
[3] *Department of Plasma Technology and Nanotechnology of High Molecular Weight Materials. Kazan National Research Technological University. K. Marx St., 68. Kazan, 420015. Tatarstan Republic. Russia.*
Phone: [1)] *+7 (843) 231-41-20,* [2)] *+7 (843) 272-52-44,* [3)] *+7 (843) 231-97-50.*
E-mail: [1)] *man-anna87@mail.ru;* [2)] *ram89_89@mail.ru;* [3)] *sisoev@kstu.ru*

*Supervising author; [+]Corresponding author
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Abstract

The work is devoted to determining the additional criterion of surface state assessment in the periodic potentiostatic method of monitoring for stainless steels. To achieve this aim the electrochemical research of austenitic steels grade 12X18H10T and 10X17H13M2T were conducted in chloride environments with concentrations of 0.1 and 0.5 M under potentiostatic polarization. An oxidizer $K_2Cr_2O_7$ was injected in the test solution for simulation the hard conditions. A comparative analysis of sample surface pre- and post-electrochemical researches were carried out using a digital metallographic microscope.

During monitoring the surface state of chromium-nickel steels is proposed using the steel electrode as a reference electrode made of the witness sample metal for registration current values fluctuations between electrodes. At that offset value of potential will be maintained as a result of synchronous change in corrosion potential of investigated working electrode and reference steel electrode.

The spectral density values for current and potential have been received using Mathematical software package named "STATISTICA" on which the impedance modulus values were calculated. On the graphs of impedance module changes constructed in logarithmic coordinates the linear trends are made. The stainless steel surface condition influences on the trend line slope value. In passive state the value of the slope approximately equals to zero; in surface state, corresponding to the boundary between the passive state and metastable pits generation state, slope takes on a positive value to 0.05; in the state of metastable pits generation slope equals 0.05÷0.5; the value of slope equals and above 0.5 corresponds to the stable pits development process on the chrome-nickel steel surface.

The angular coefficient of graphic dependence lgf - lgZ(f)[Ω] which allows uniquely identifying a trend of stable pit's growth is proposed as an additional criterion for surface state assessment in the monitoring method.

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