Noise Suppression Technique Application in SVET Studies of Chromatized Aluminum Alloys Surface

Rogelio Ramos Irigoyen[1], Roumen Zlatev[1], Margarita Stoytcheva[1], Juan Francisco García[1], Benjamín Valdez[1], Tsvetan Dobrev[2]

[1]Instituto de Ingeniería, UABC, Blvd. Benito Juárez s/n, 21280 Mexicali, México
[2] Physical Chemistry Institute of Bulgarian Academy of Sciences, Acad. G. Bonchev str, bl. 10
e-mail: margarita@iing.mxl.uabc.mx

The SVET is advanced measuring technique allowing the determination of the current distribution above the freely corroding metal surface and hence the localization of the surface defects, caused by pitting, inter-granular or galvanic corrosion [1, 2, 3].

The vibration of the SVET sensing tip convert the potential gradient to an a.c. signal with a known frequency allowing the application of appropriate electronic circuits for signal separation such as selective filters or analogous or digital lock-in-amplifiers (LIA). The LIA is able to process signals having signal to noise ratio (S/N) as low as -60 dB or even less, successfully separating the signal from the noise thus allowing the achievement of better resolution by SVET in respect to the SRET [4]. Usually, the vibrating electrode driving voltage serves as a reference frequency for the LIA.

In spite of its general simplicity the main SVET drawback however is the application of expensive equipment such as LIA which combined with the long measuring time resulting from the small scanning step limits the SVET wide application.

The objective of the present work is the development of a simple noise suppression measuring technique, replacing the lock-in-amplifier (LIA) and its application for pitting corrosion studies of chromated aerospace aluminum alloys by SVET.

The main source of noise at small amplitude electrochemical signals measurements is the power line. To suppress it efficiently a simple signal processing unit based on synchronization of the sensing probe vibration with the power line frequency was developed. Its application allows 136.3 times suppression of the noise at a time constant of 300 ms and 823 times at 720 ms time constant. Thus, a cost efficient replacement of the, usually used in SVET measurements lock-in amplifier was achieved.

A SVET measuring unit equipped with this signal processing unit was applied for pitting corrosion studies of chromate conversion coatings protected aerospace aluminum alloys 6061 T6 and 2024 T3. The results were validated applying the standardized methods based on NSS chamber application MIL-C-5541.

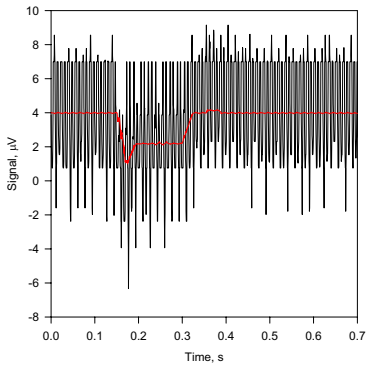

Figure 1. The input and the output signal obtained by SVET with the noise suppression unit application. Sample: Aluminum alloy 6061 T6

Key words: SVET, pitting corrosion, noise suppression, chemical conversion coatings, aerospace aluminium alloys

REFERENCES

1. Jaffe L.F., R. Nucitelli, Journal of Cell Biology, 63, 614, (1974).
2. Isaacs H. S. Journal of the Electrochemical Society, 138, 722 (1991).
3. Isaacs H. S., B. Vias, in Electrochemical Corrosion Testing, ASTM STP 727, F. Mansfeld, U. Bertocci, eds., p. 3, ASTM, Baltimore (1981).
4. Thornhill R. S., U. R. Evans, Journal of the Chemical Society, 614 (1938).