The naphthenic acid number influence analysis at the stainless steel corrosion behavior - Electrochemical noise technic

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The naphthenic corrosion control has been a challenge for heavy oils refineries. Its monitoring is essential for evaluating the applied operational corrosion control and to establish operational limits. Much research has been done focusing on the understanding about critical parameters and methodologies for monitoring its corrosion rate. None of them has presented a feasible online real time monitoring process.

The presented work aims to develop the use of the Electrochemical Noise (EN) technique as a process for evaluating the refinery processes control parameters and corrosion monitoring by naphthenic acids.

The corrosion control is of great importance for safety and operational performance at refineries. The crude oils used to present, at its composition, a range of contaminants that induce corrosion damages during the higher temperature distillation process, as the naphthenic acid. (SILVA, 2010).

The electrochemical noise technique has recently been considered, by the researches community, as a feasible online and real time technique for monitoring the naphthenic corrosion in spite the high environment resistivity (SILVA, 2010). The electrochemical noise signal is a consequence of spontaneous current and potential fluctuations caused by corrosion or surface chemical reactions processes. With a proper signal analysis it could be possible to obtain information about the corrosion rate and the corrosions modus. That means, whether the corrosion is a general or localized process (COTTIS, 2006).

This work considers the evaluation of the 316 stainless steel behavior at a mineral oil containing naphthenic acid for 5 hours. It was considered solutions with different naphthenic acid numbers and different temperatures. The electrodes were tree equal 316 stainless steel rods. The solutions were prepared with Total Acid Number - TAN´s of 0,5 mg KOH/g, 1,5 mg KOH/g and 2,5 mg KOH/g. The tested temperatures were 25°C, 65°C e 120°C.

The experiment was done by using a potenciostat/galvanostat ZRA Reference 600 from Gamry Instruments. The selected operational frequency was 500 Hz with an acquisition frequency of 10 Hz. The electrochemical noise signal was treated considering the AL-MAZEEDI and COTTIS (2004) methodology.

The obtained results for noise resistance and frequency of events, for different TAN and temperatures are presented at figure 1 and 2.

Figure 1 – Noise Resistance x Frequency for TAN 0,5, 1,5 and 2,5 mg KOH/g at 120°C.

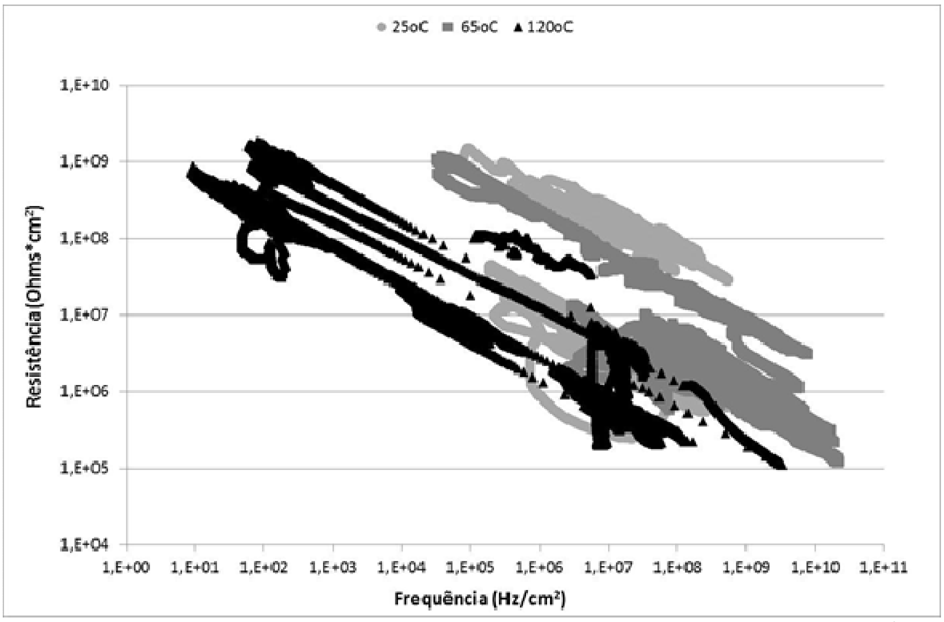

Figure 2 – Noise Resistance x Frequency for TAN 1,5 mg KOH/g at 25, 65 e 120°C.

The obtained results indicates that it could be possible to use the electrochemical noise technique as a corrosion monitoring one in spite of the high solution resistivity and low temperatures for naphthenic acid corrosion process. The corrosion susceptibility increases with TAN and temperature as indicated by the noise resistance decreasing. The corrosion modus displaces from general corrosion to localized corrosion as indicated by the decrease at the frequency response.

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