Activation of Carbon(Graphite) SPE sensors:

SPE sensors with a Carbon(Graphite) working electrode may require **(**due to the content of the polymer binder in the Carbon(Graphite) paste**)** activation before measurement [1]. The activation of the working electrode of the sensor serves to increase the activity of the surface and remove impurities – for working electrodes formed by active particles bound in polymer carriers, it opens the active surface.

Note: Unfortunately, there is no universal activation method for Carbon(Graphite) sensors. It depends on the intended use of the sensors (future determined substance by the sensor), measurement conditions, sensor parameters such as thickness, diameter of the working electrode to be activated, etc. The activation method must be optimized for the given sensor. It cannot therefore be guaranteed that the named activation methods will be suitable for the customer. An example of cleaning/activation for DNA sensors is in the publication by *Nature Protocols Vol.2.No.11 2007 pg.2875-2880 – Preparation of electrode-immobilized, redox-modified oligonucleotides for electrochemical DNA and aptamer-based sensing – Yi Xiao, Rebecca Y Lai & Kevin W Plaxco.*

Based on a search of works dealing with the issue of Carbon(Graphite) sensor activation and subsequent measurements, the following two electrochemical activation methods, which can be easily performed in a laboratory environment, were found to be the most effective for graphite BVT sensors during measurment of FerriFerro (These are just examples of what were found by BVT in our Lab conditions and may vary based on the customers testing conditions):

1. **Cyclic voltammetry in FerriFerro after previous activation by 20 scans in 0.5 M NaOH, potential range -2 +2 V, speed 100 mV/s**

2. **Cyclic voltammetry in FerriFerro after previous activation by 40 scans in 0.5 M KOH, potential range -1.5 +1 V, speed 100 mV/s**

The effectiveness of the above activation methods was assessed based on the changes in ΔI and ΔE (the difference between the maxima of the cathodic and anodic peaks in the cyclic voltammograms of the sensors) before and after the activation of the working electrode of the sensor. The measurement was carried out in the 0.005 M potassium ferri-ferro cyanide in 0.2 M KOH.

An increase in ΔI after activation indicates a higher response of the sensor to the measured analyte and a decrease ΔE after activation means faster electron transfer on the working electrode of the sensor.

Demonstration of activation methods

Graphs (Fig. 1 and 2) of cyclic voltammograms of Carbon(Graphite) sensors AC1.W5.RS 2 mm **(**WE with manually applied Carbon(Graphite) by microdispensing a drop of precise amount of Carbon(Graphite) by a specialised syringe**)** before and after activation.

Black Line is the result before activation.

Red Line is the result after activation.

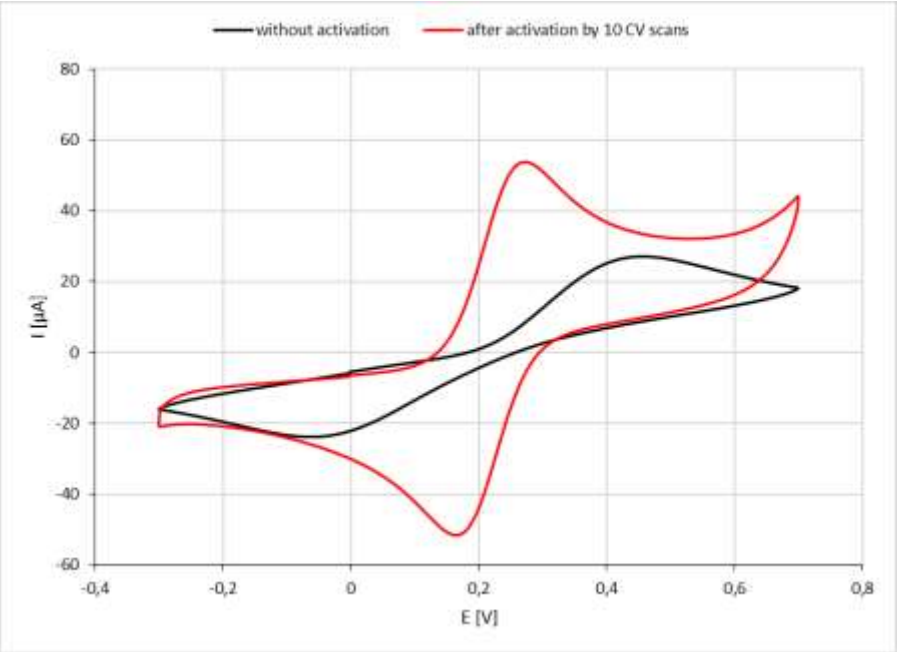

Fig. 1: Cyclic voltammograms in FerriFerro after previous activation by 20 scans in 0,5 M NaOH, potential range -2 +2 V, scan rate 100 mV/s

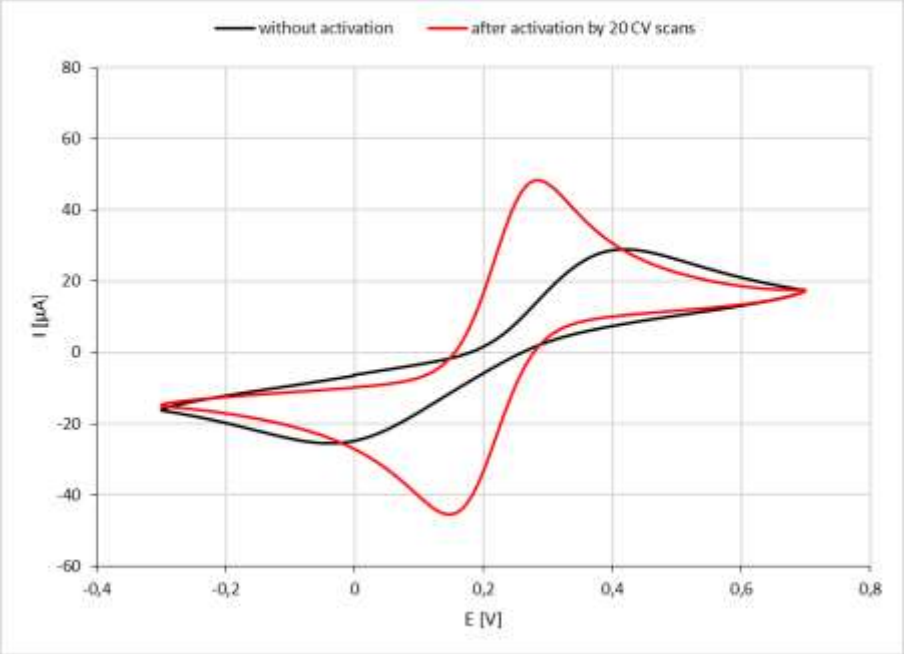

Fig. 2: Cyclic voltammograms in FerriFerro after previous activation by 40 scans in 0,5 M KOH, potential range -1,5 +1 V, scan rate 100 mV/s

Reference:

[1] KREJČÍ, Jan, Jan PRÁŠEK, Lukáš FUJCIK, Sameh KHATIB, Edita HEJÁTKOVÁ, Luboš JAKUBKA a Louisa GIANNOUDI. Screen-printed sensors with graphite electrodes – comparison of properties and physical method of sensitivity enhancement. Microelectronics International [online]. 2004, 21(3), 20-24 [cit. 2022-05-25]. ISSN 1356-5362.