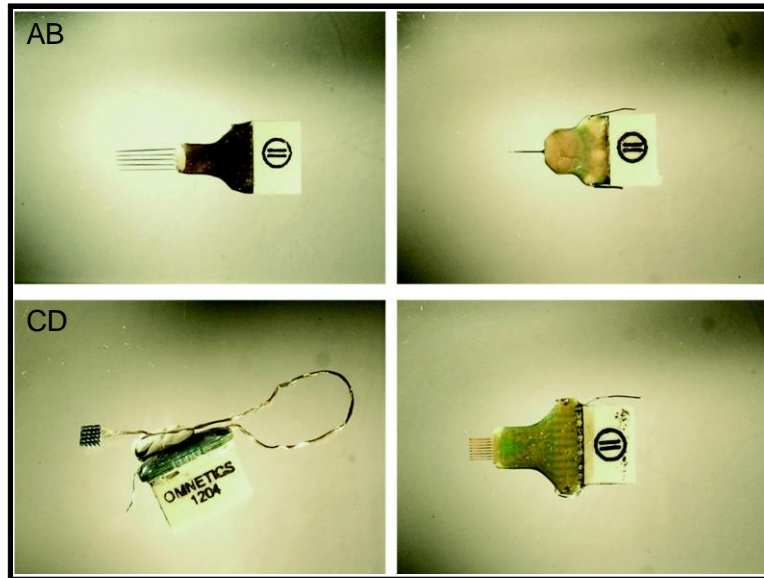
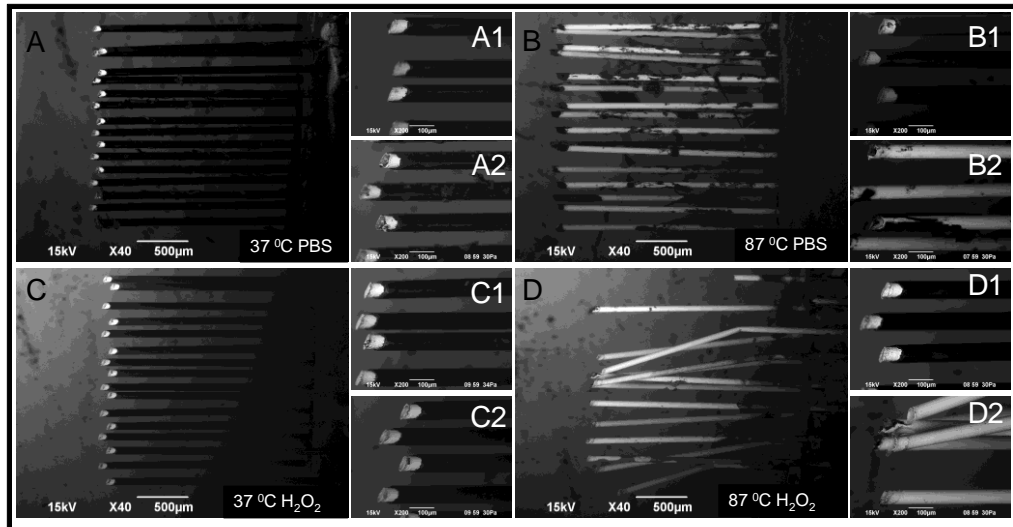


## Supplementary figures



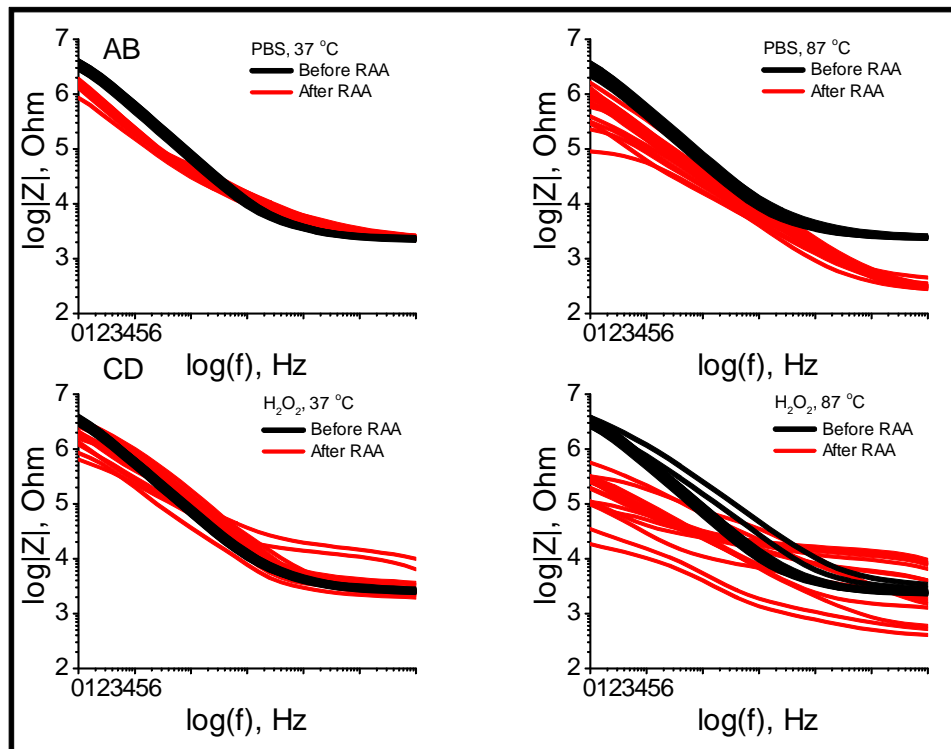
**Supplementary Figure 1.** Optical images of cortical neural implants used in the study.

Microprobes (A), NeuroNexus (B), Blackrock (C) and TDT (D) arrays were used in reactive accelerated aging (RAA) experiments.



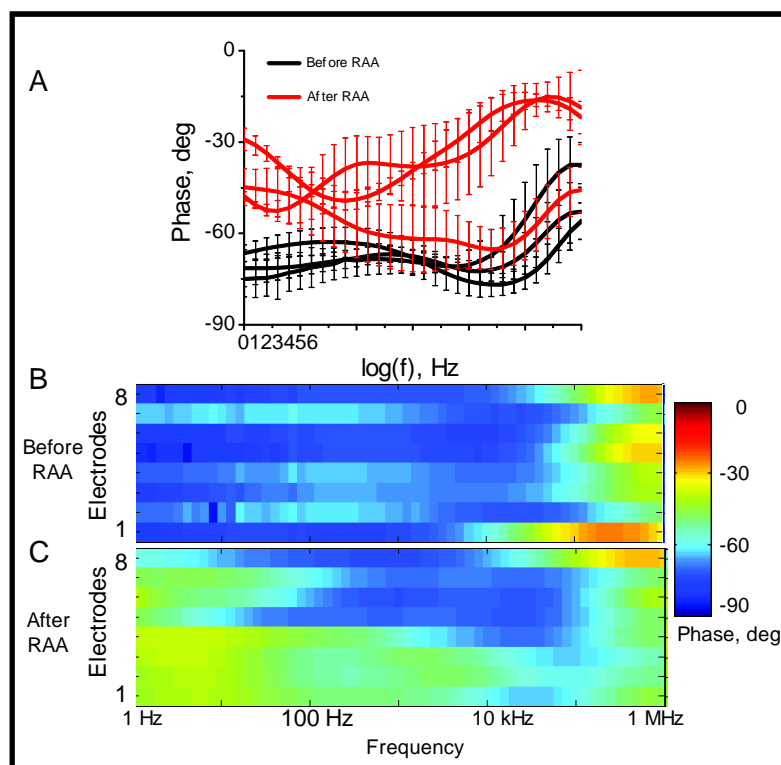
**Supplementary Figure 2.** Scanning electron microscopy imaging of four TDT neural implants exposed to different reactive accelerated aging (RAA) conditions.

TDT implants exposed to RAA for 7 days at 37 °C in PBS (**A** - after RAA, high resolution images before **A1** and after **A2**); RAA for 7 days at 87 °C in PBS (**B** - after RAA, high resolution images before **B1** and after **B2**); RAA for 7 days at 37 °C in hydrogen peroxide (**C** - after RAA, high resolution images before **C1** and after **C2**), RAA for 7 days at 87 °C in hydrogen peroxide (**D** - after RAA, high resolution images before **D1** and after **D2**).



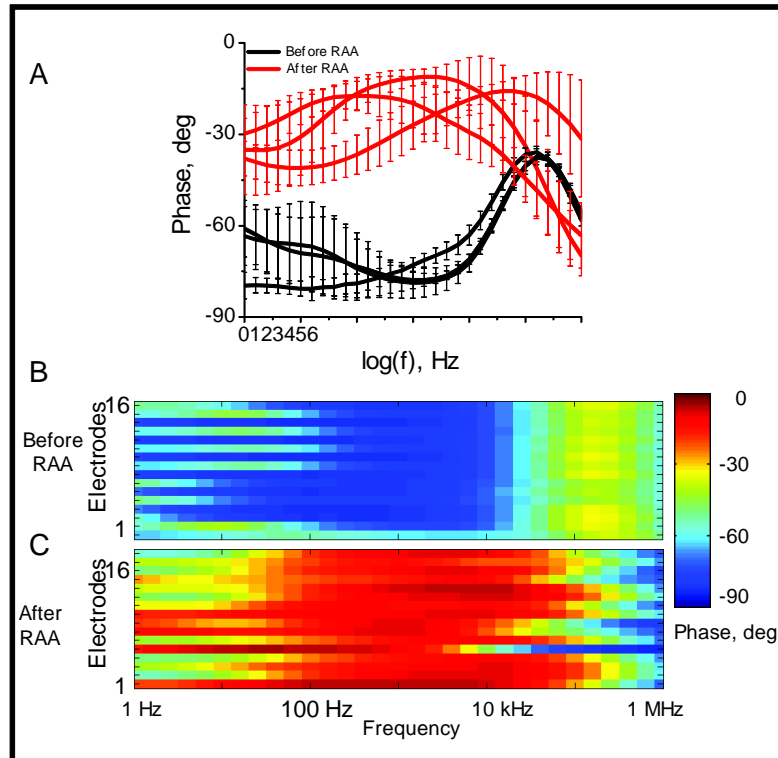
**Supplementary Figure 3.** Impedance amplitude spectra for four TDT neural implants exposed to different reactive accelerated aging (RAA) conditions.

TDT implants exposed to the RAA 7 days at 37 °C in PBS (**A**), 87 °C in PBS (**B**), 37 °C in hydrogen peroxide (**C**), 87 °C in hydrogen peroxide (**D**). Each implant has 16 electrodes, black traces represent impedance before and red traces represent impedance after RAA for each electrode.



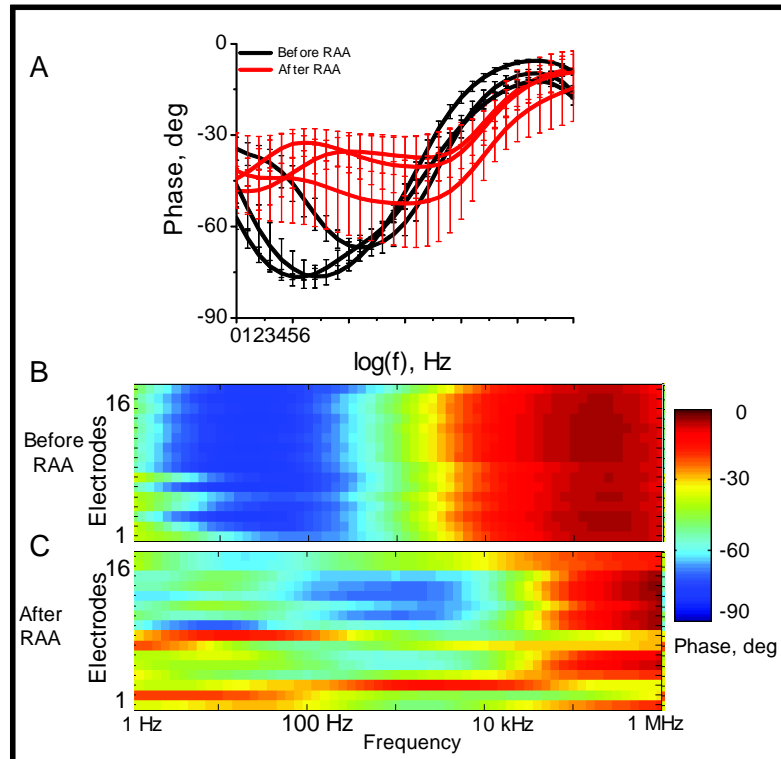
**Supplementary Figure 4.** Effect of the reactive accelerated aging (RAA) on the Microprobes neural implants examined with EIS.

The impedance phase spectra for implants before (black trace) and after (red trace) the RAA (**A**). The solid traces represent the mean for each of the three implants and the whiskers represent the standard deviation. The mean and the standard deviation were calculated from the data for 8 electrodes for each of the implants. Impedance phase spectra presented as pseudocolor plots before (**B**) and after (**C**) the RAA for all 8 microelectrodes of a representative implant with frequency located on the abscissa, electrode number located on the ordinate and color coding for the impedance phase.



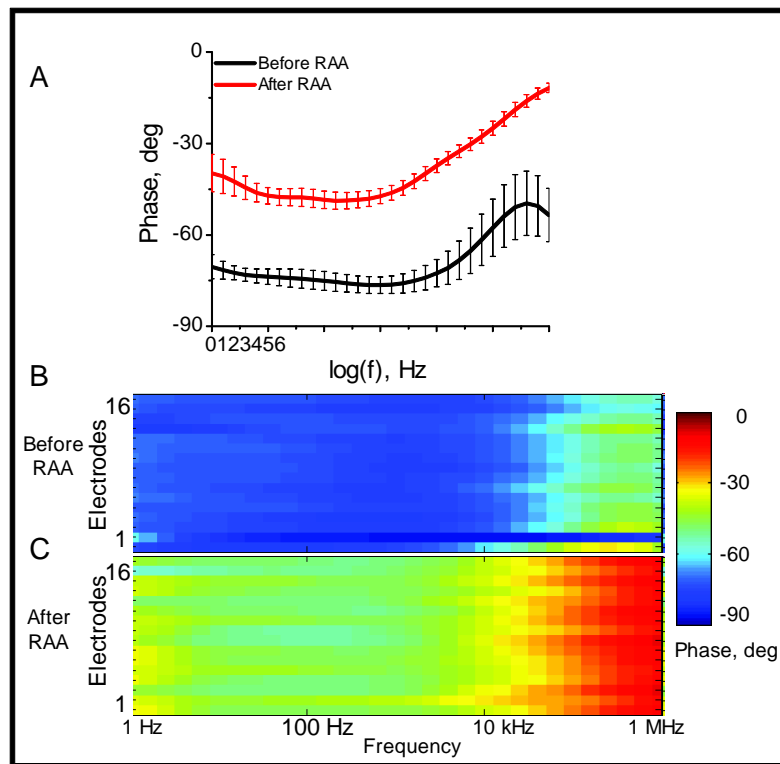
**Supplementary Figure 5.** Effect of the reactive accelerated aging (RAA) on the NeuroNexus neural implants examined with EIS.

The impedance phase spectra for implants before (black trace) and after (red trace) the RAA (**A**). The solid traces represent the mean for each of the three implants and the whiskers represent the standard deviation. The mean and the standard deviation were calculated from the data for 16 electrodes for each of the implants. Impedance phase spectra presented as pseudocolor plots before (**B**) and after (**C**) the RAA for all 16 microelectrodes of a representative implant with frequency located on the abscissa, electrode number located on the ordinate and color coding for the impedance phase.



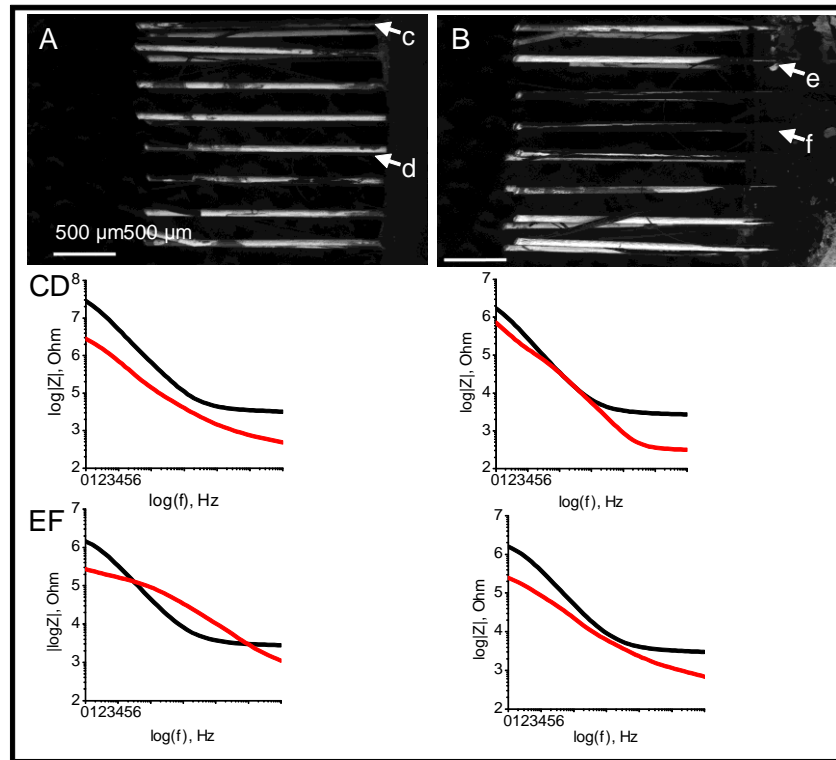
**Supplementary Figure 6.** Effect of the reactive accelerated aging (RAA) on the Blackrock neural implant examined with EIS.

The impedance phase spectra for implants before (black trace) and after (red trace) the RAA (**A**). The solid traces represent the mean for the implant and the whiskers represent the standard deviation, which were calculated from the data for 16 electrodes. Impedance phase spectra presented as pseudocolor plots before (**B**) and after (**C**) the RAA for all 16 microelectrodes of a representative implant with frequency located on the abscissa, electrode number located on the ordinate and color coding for the impedance phase.



**Supplementary Figure 7.** Effect of the reactive accelerated aging (RAA) on the TDT neural implants examined with EIS.

The impedance phase spectra for implants before (black trace) and after (red trace) the RAA (A). The solid traces represent the mean for each of the three implants and the whiskers represent the standard deviation. The mean and the standard deviation were calculated from the data for 16 electrodes for each of the implants. Impedance phase spectra presented as pseudocolor plots before (B) and after (C) the RAA for all 16 microelectrodes of a representative implant with frequency located on the abscissa, electrode number located on the ordinate and color coding for the impedance phase.



**Supplementary Figure 8.** Degradation of TDT neural implants and change impedance spectra. Full spectra for four different microelectrodes **c**, **d**, **e** and **f** from TDT neural implant before (black trace) and after (red trace) the RAA that are marked on electron micrographs (**A**) and (**B**). For impedance at 1 kHz, the largest increase was observed for the microelectrode **e** (**E**) and the largest decrease was observed for microelectrode **c** (**C**). Electron microscopy revealed the least pronounced delamination of polyimide insulation for microelectrode **f** (**F**) and the most noticeable delamination for microelectrode **d** (**D**).