Supplementary Information

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Comparative study of platinum electroplating to improve micro gold electrode arrays with LCP laminate

Short title: platinum coatings of LCP electrodes

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Keywords: charge storage capacity; electrode impedance; electrode model; electroplating, platinum; pulsed current; ultrasound

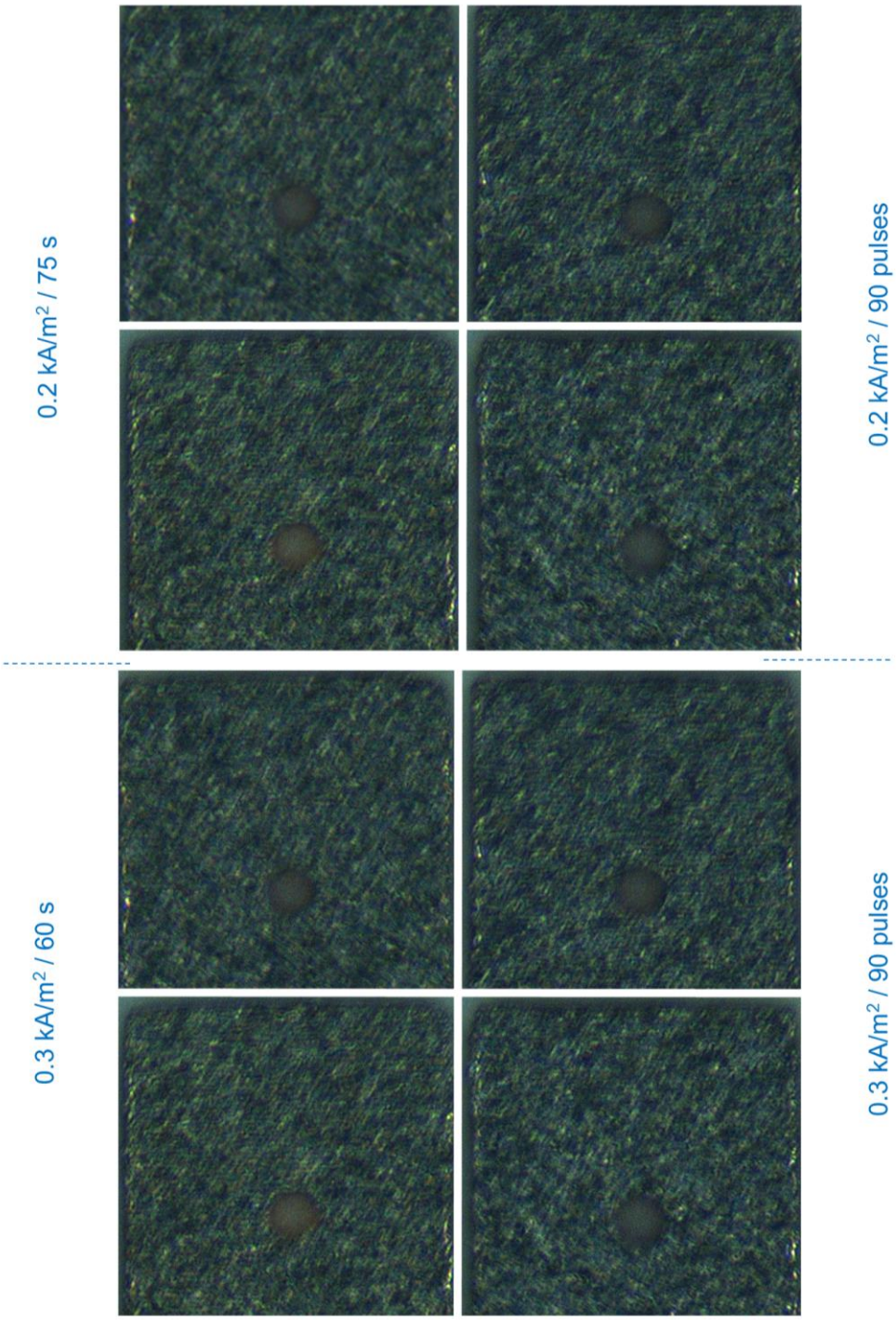

Figure S1: Optical Images (DS4500, Leica microsystems) from the rectangular-shaped electrode sites for four different electroplating processes. Left top: constant current with 0.2 kA/m^2 for 75 s. Left bottom: constant current with 0.3 kA/m^2 for 60 s. right top: pulsed current with 0.2 kA/m^2 for 90 pulses. Right bottom: pulsed current with 0.3 kA/m^2 for 90 pulses.

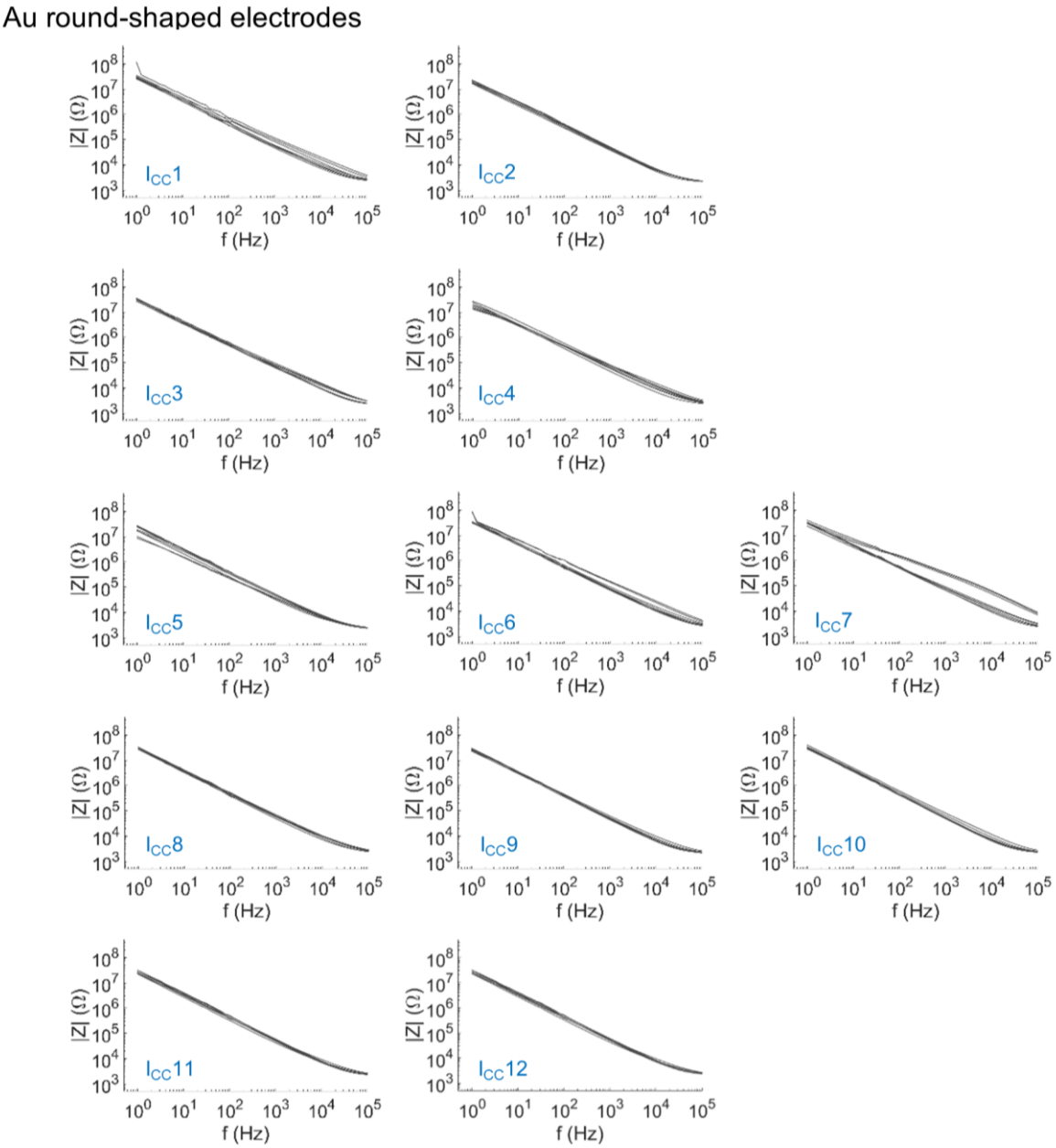

Figure S2: Impedance magnitudes (|Z|) of the **round-shaped** gold electrode sites used for constant current (I_{CC}) electroplating grouped along the electroplating conditions.

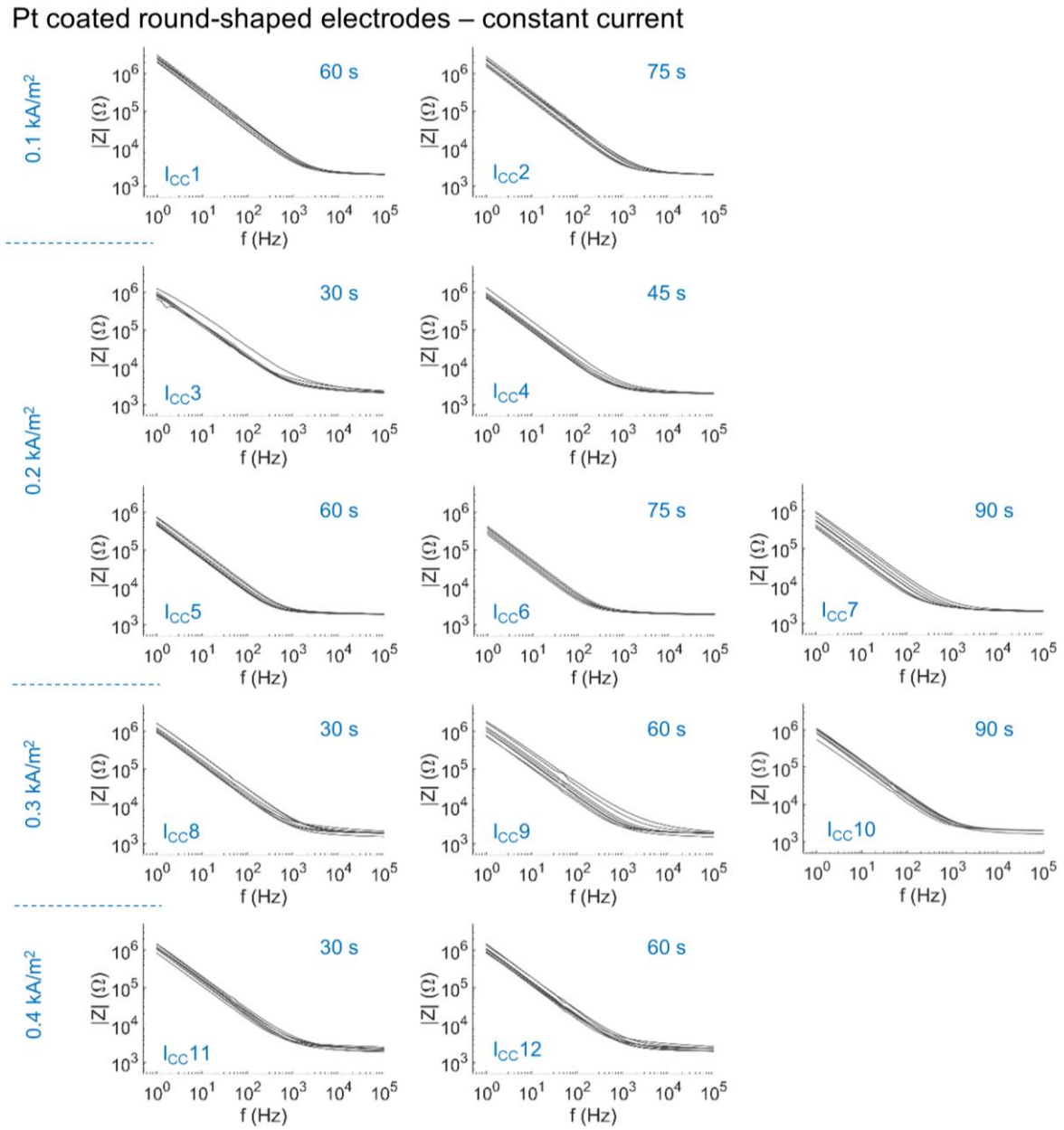

Figure S3: Impedance magnitudes (|Z|) of the **round-shaped** platinum electrode sites after constant current (I_{CC}) electroplating grouped along the electroplating conditions. **0.1 kA/m²**: 1) 60 s, 2) 75 s; **0.2 kA/m²**: 3) 30 s, 4) 45 s, 5) 60 s, 6) 75 s, 7) 90 s; **0.3 kA/m²**: 8) 30 s, 9) 60 s, 10) 90 s; **0.4 kA/m²**: 11) 30 s, 12) 60 s. **Ultrasound: 50%** for all conditions.

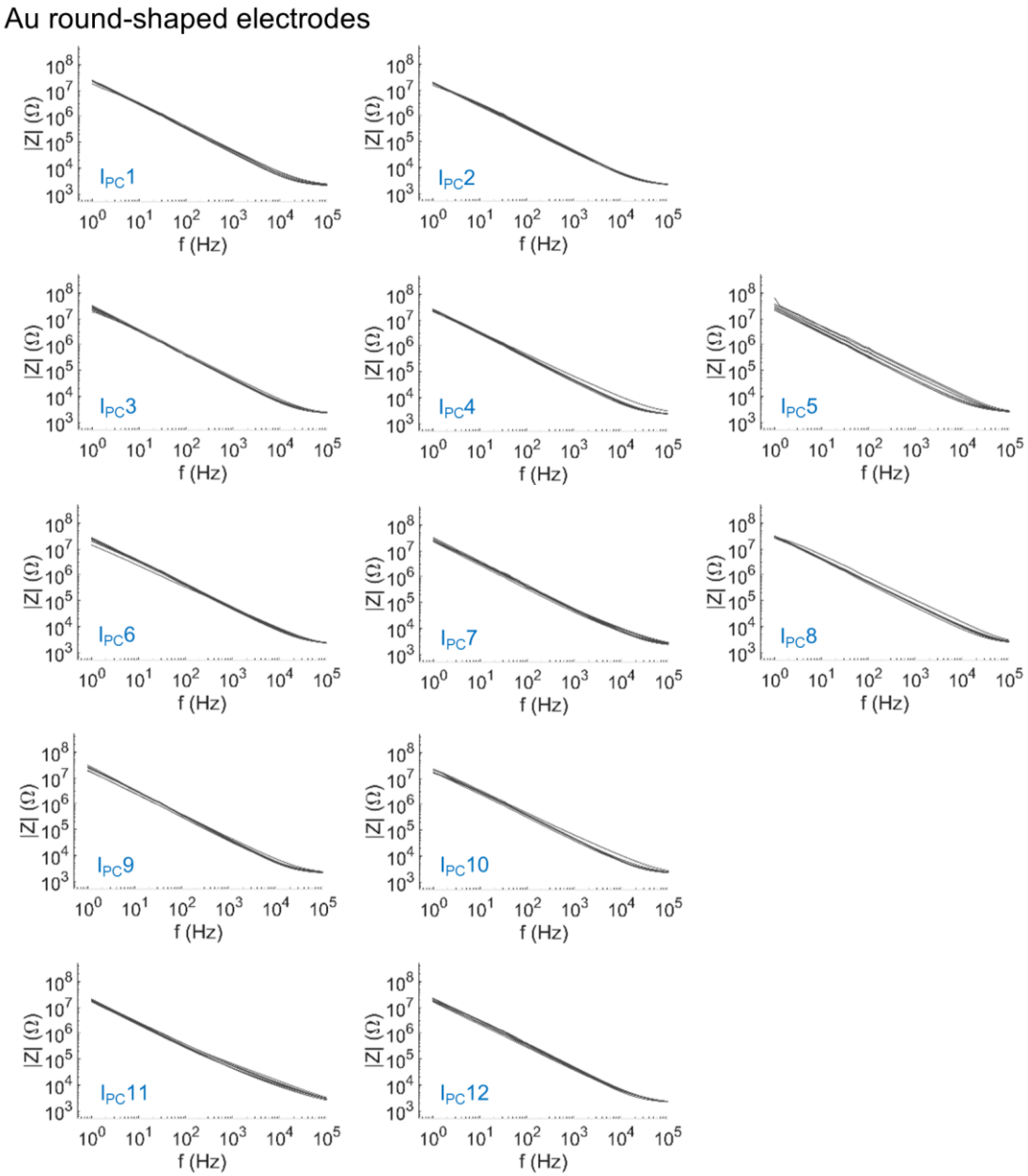

Figure S4: Impedance magnitudes (|Z|) of the **round-shaped** gold electrode sites used for pulsed current (I_{PC}) electroplating grouped along the electroplating conditions.

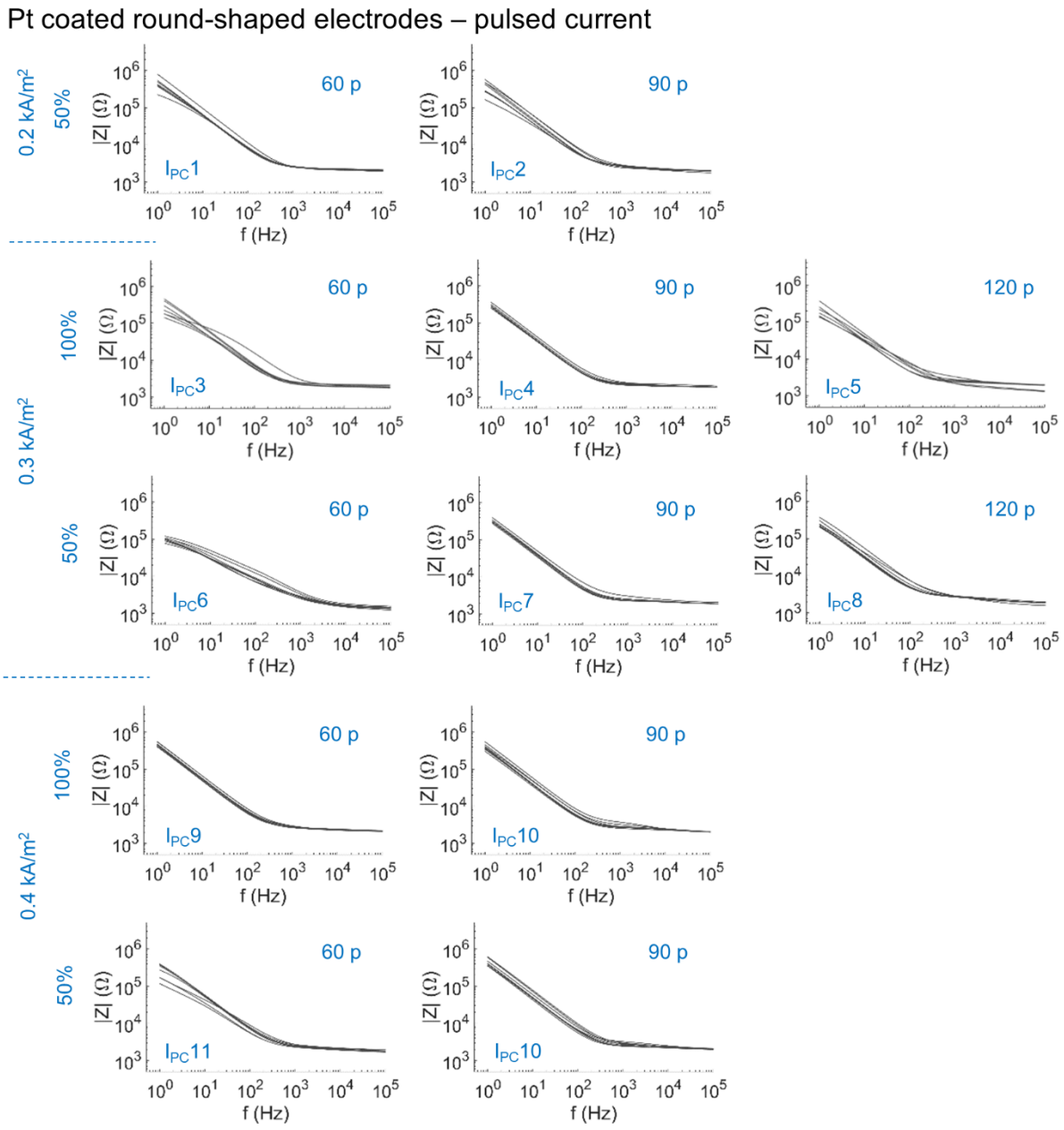

Figure S5: Impedance magnitudes (|Z|) of the **round-shaped** platinum electrode sites after pulsed current (I_{PC}) electroplating grouped along the electroplating conditions. **0.2 kA/m², Ultrasound 50%**: 1) 60 pulses, 2) 90 pulses; **0.3 kA/m², Ultrasound 100%**: 3) 60 pulses, 4) 90 pulses, 5) 120 pulses; **0.3 kA/m², Ultrasound 50%:** 6) 60 pulses, 7) 90 pulses, 8) 120 pulses; **0.4 kA/m², Ultrasound 100%:** 9) 60 pulses, 10) 90 pulses; **0.4 kA/m², Ultrasound 50%:** 11) 60 pulses, 12) 90 pulses.

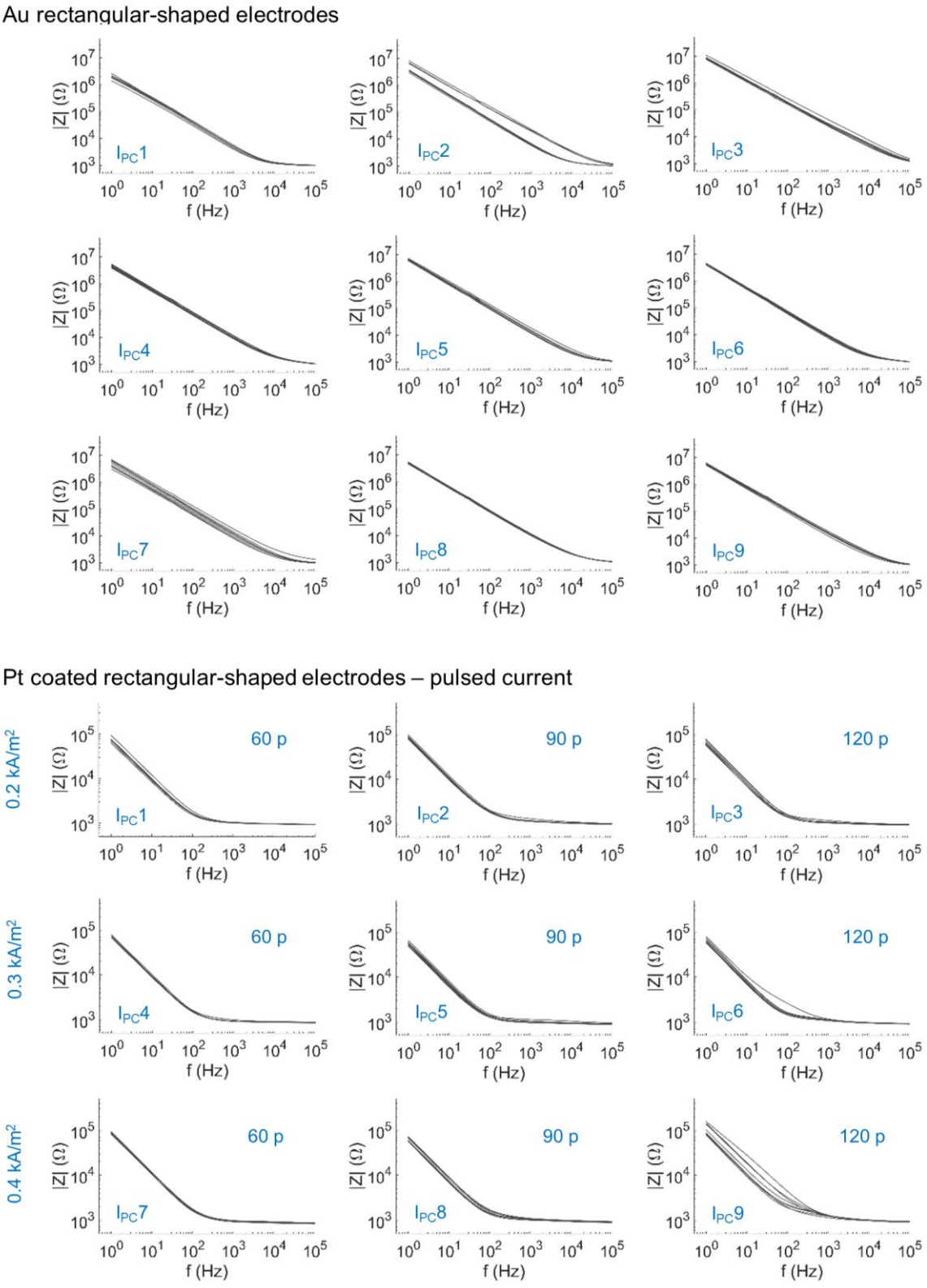

Figure S6: Impedance magnitudes (|Z|) of the **rectangular-shaped** gold electrode sites (top) and platinum electrode sites (bottom) used for pulsed current (I_{PC}) electroplating grouped along the electroplating conditions. . **0.2 kA/m²**: 1) 60 pulses, 2) 90 pulses, 3) 120 pulses; **0.3 kA/m²**: 4) 60 pulses, 5) 90 pulses, 6) 120 pulses; **0.4 kA/m²:** 7) 60 pulses, 8) 90 pulses, 9) 120 pulses; **Ultrasound 50% in all conditions**

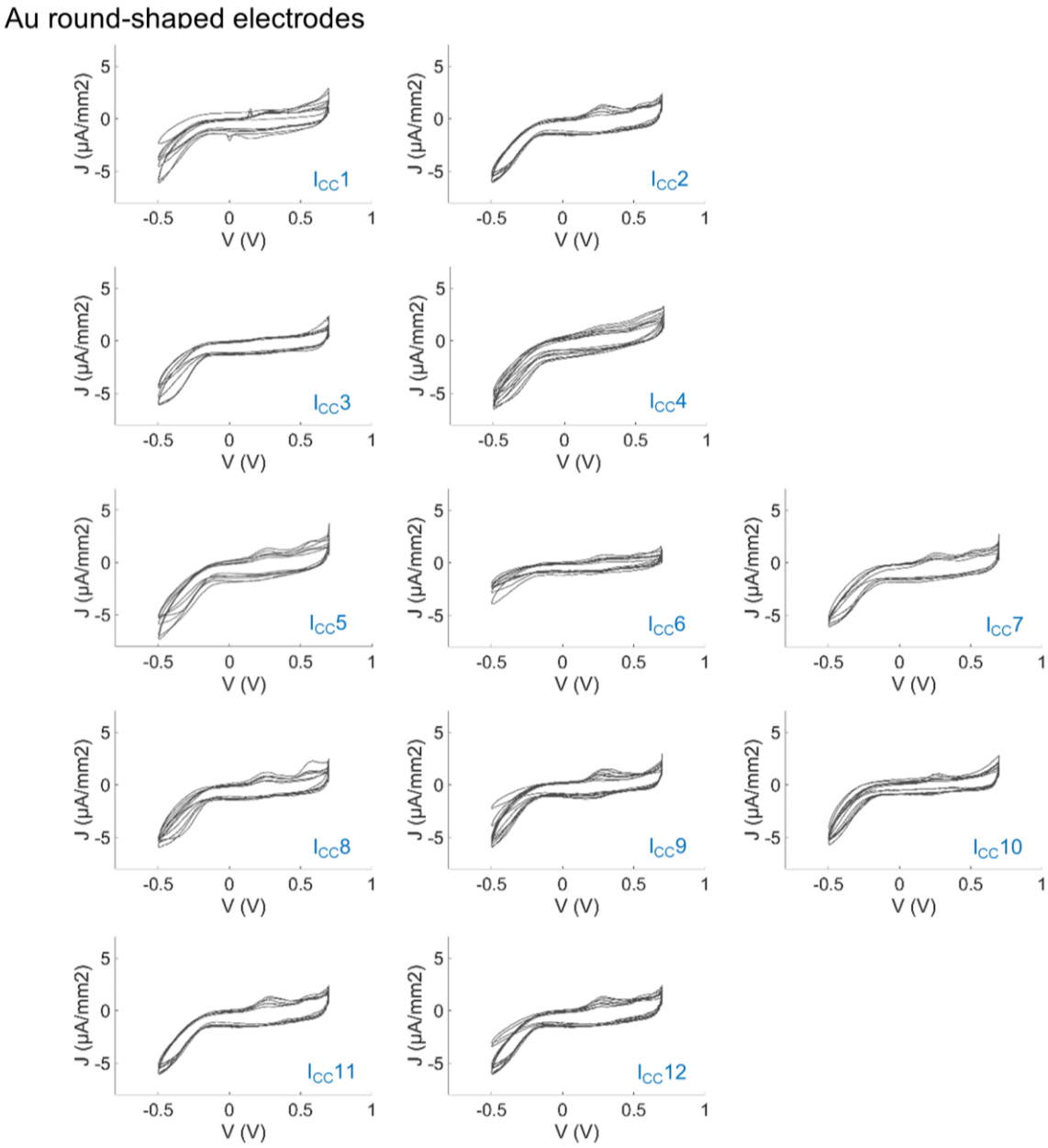

Figure S7: Cyclic voltammograms of the **round-shaped** gold electrode sites used for constant current (I_{CC}) electroplating grouped along the electroplating conditions. (J: current density; V: electrode voltage)

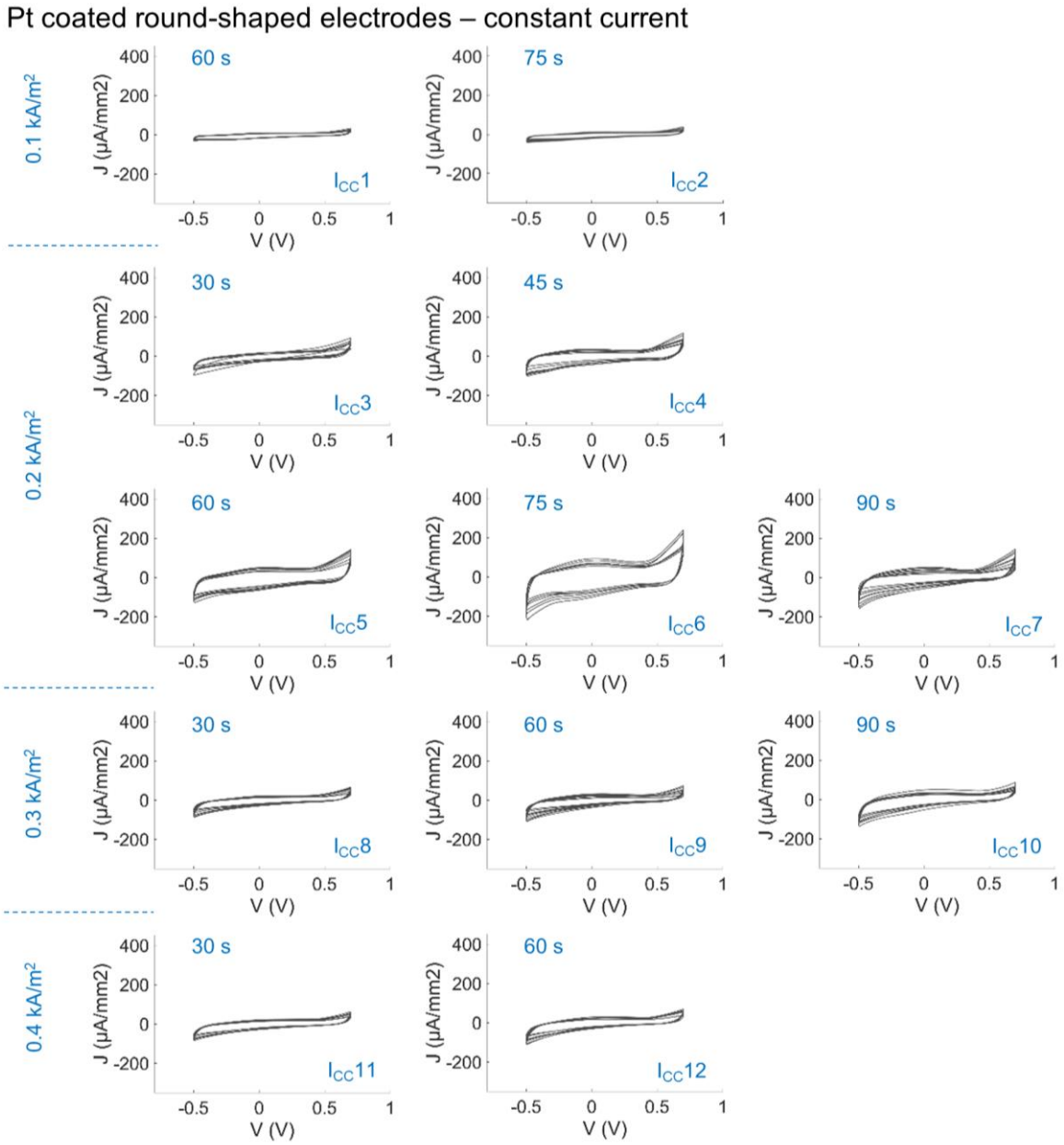

Figure S8: Cyclic voltammograms of the **round-shaped** platinum electrode sites after constant current (I_{CC}) electroplating grouped along the electroplating conditions. **0.1 kA/m²**: 1) 60 s, 2) 75 s; **0.2 kA/m²**: 3) 30 s, 4) 45 s, 5) 60 s, 6) 75 s, 7) 90 s; **0.3 kA/m²**: 8) 30 s, 9) 60 s, 10) 90 s; **0.4 kA/m²**: 11) 30 s, 12) 60 s. **Ultrasound: 50%** for all conditions. (J: current density; V: electrode voltage)

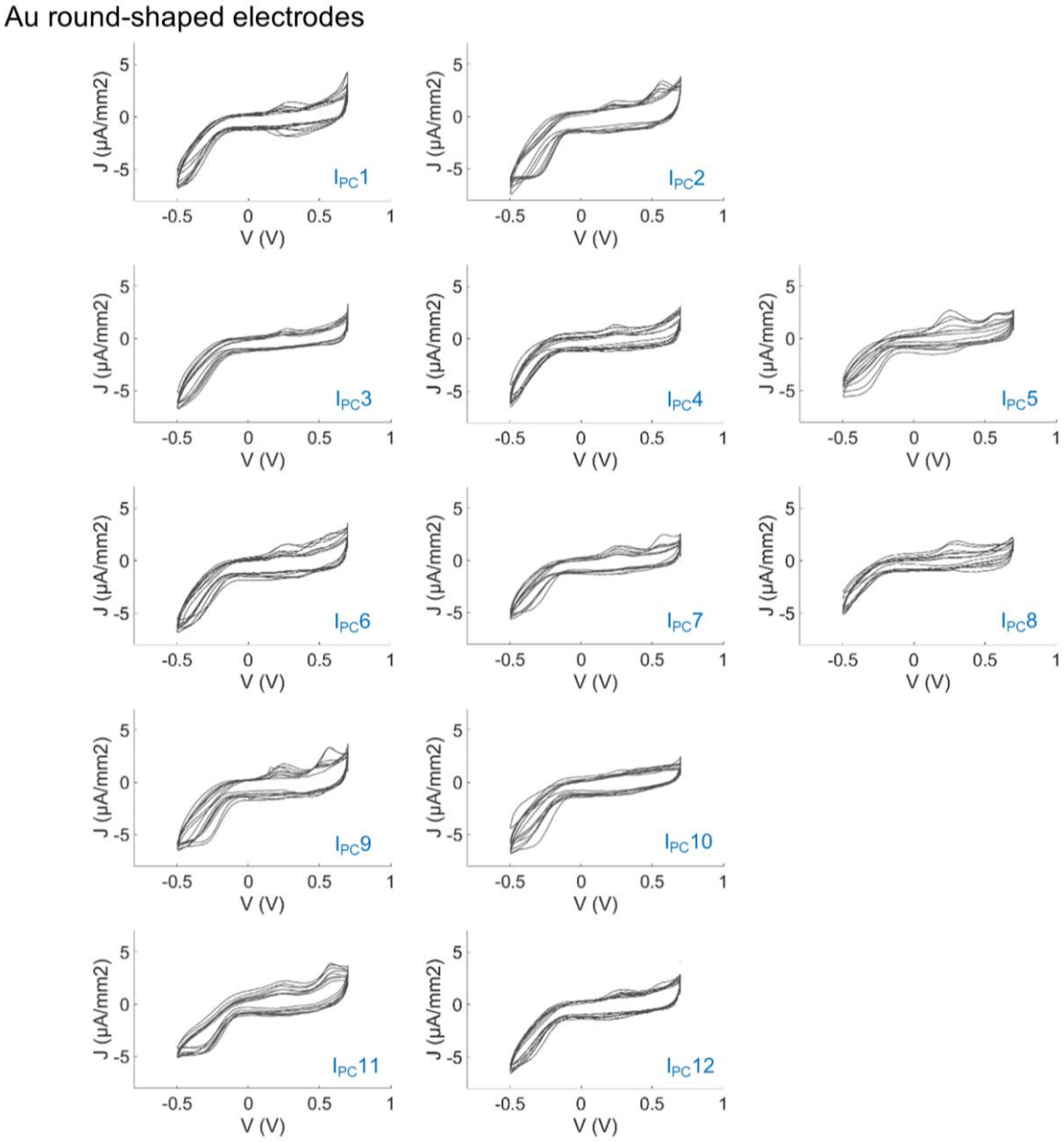

Figure S9: Cyclic voltammograms of the **round-shaped** gold electrode sites used for pulsed current (I_{PC}) electroplating grouped along the electroplating conditions. (J: current density; V: electrode voltage)

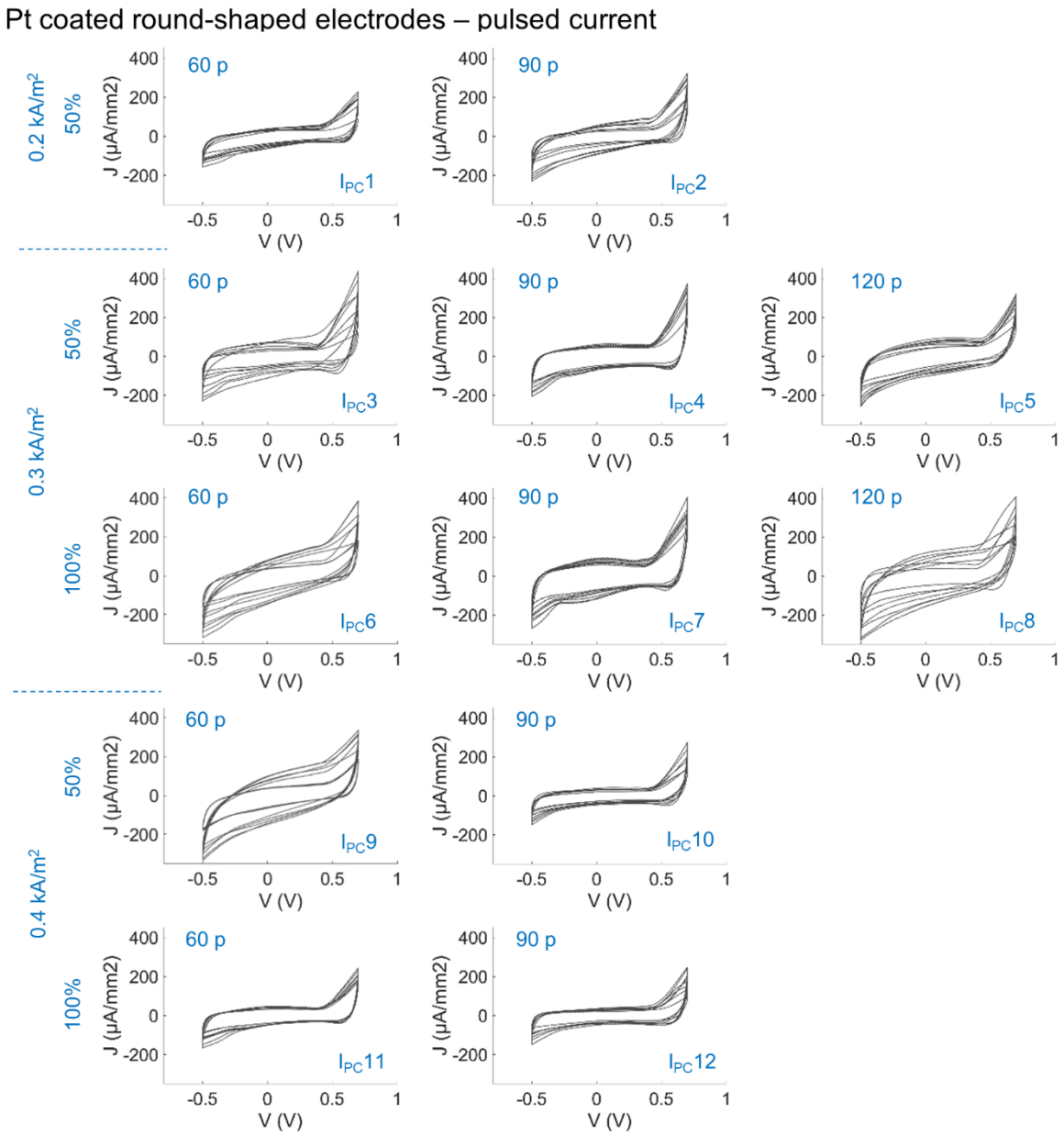

Figure S10: Cyclic voltammograms of the **round-shaped** platinum electrode sites after pulsed current (I_{PC}) electroplating grouped along the electroplating conditions. **0.2 kA/m², Ultrasound 50%**: 1) 60 pulses, 2) 90 pulses; **0.3 kA/m², Ultrasound 100%**: 3) 60 pulses, 4) 90 pulses, 5) 120 pulses; **0.3 kA/m², Ultrasound 50%:** 6) 60 pulses, 7) 90 pulses, 8) 120 pulses; **0.4 kA/m², Ultrasound 100%:** 9) 60 pulses, 10) 90 pulses; **0.4 kA/m², Ultrasound 50%:** 11) 60 pulses, 12) 90 pulses. (J: current density; V: electrode voltage)

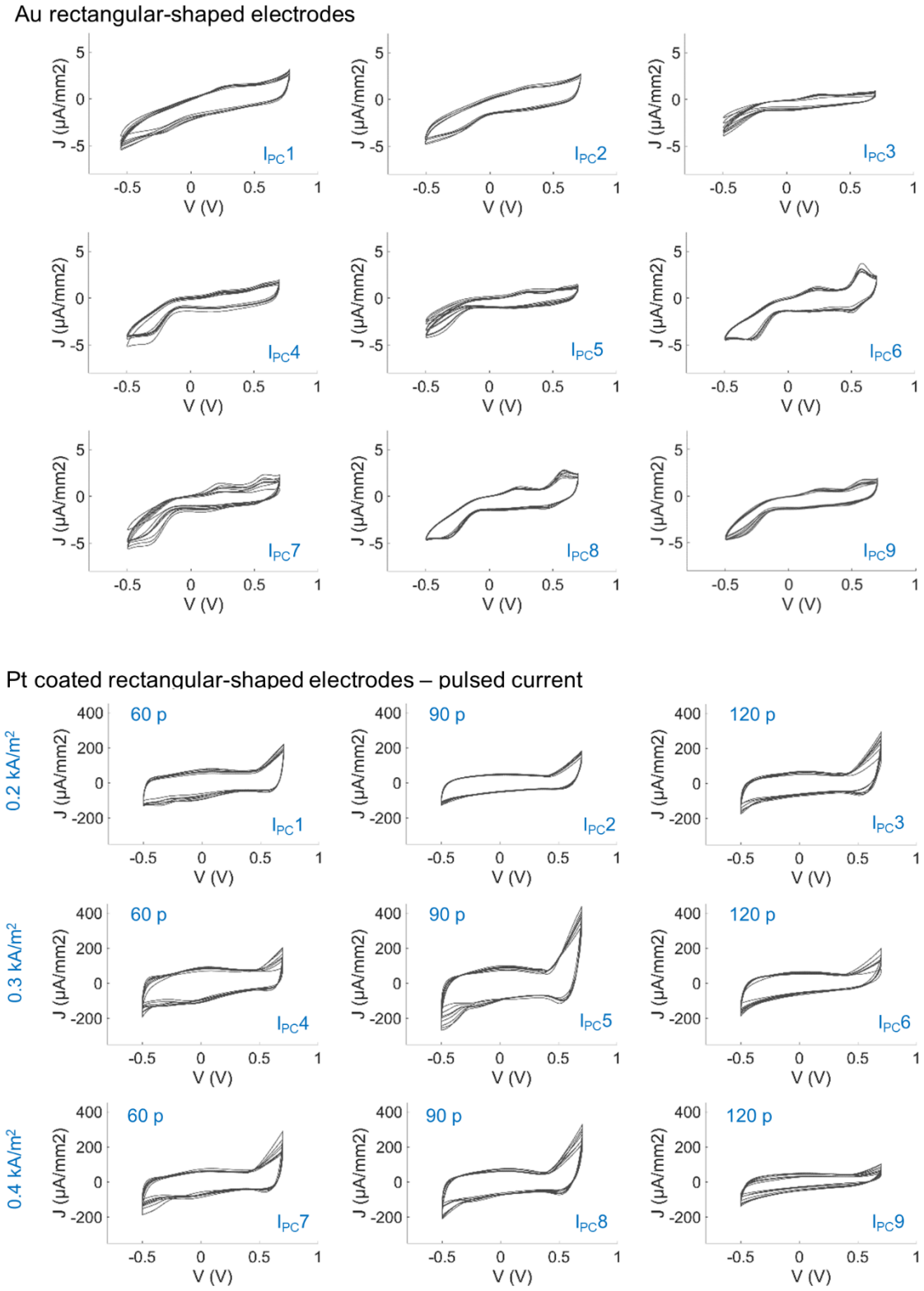

Figure S11: Cyclic voltammograms of the **rectangular-shaped** gold electrode sites (top) and platinum electrode sites (bottom) used for pulsed current (I_{PC}) electroplating grouped along the electroplating conditions. . **0.2 kA/m²**: 1) 60 pulses, 2) 90 pulses, 3) 120 pulses; **0.3 kA/m²**: 4) 60 pulses, 5) 90 pulses, 6) 120 pulses; **0.4 kA/m²:** 7) 60 pulses, 8) 90 pulses, 9) 120 pulses; **Ultrasound 50%** in all conditions**.** (J: current density; V: electrode voltage)