Electronic Supplementary Material (ESI) for Nanoscale.


**Table 2. Fitted parameters obtained from the circuit presented in figure 8.a for the epoxy coating without any inhibitor on AA 2024-T3 after 312, 1000, 1272, 1800, 2376, 2448, 4176 and 4224 hours in 3.5% NaCl solution.**

| **Time** | hours | **312** | | **1000** | | **1272** | | **1800** | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **error** | | **error** | | **error** | | **error** |
| $\mathbf{R_{sol}}$ | Ω cm$^2$ | 26.4 | ±0.109 | 30.4 | ±0.021 | 29 | ±0.179 | 32.7 | ±0.399 |
| $\mathbf{C_{coat}}$ | nF cm$^{-2}$ | 0.731 | ±0.063 | 0.702 | ±0.0198 | 0.752 | ±0.045 | 0.749 | ±0.026 |
| $\mathbf{n_{coat}}$ | | 0.967 | ±0.008 | 0.978 | ±0.003 | 0.973 | ±0.006 | 0.976 | ±0.003 |
| $\mathbf{R_{po}}$ | GΩ cm$^2$ | 0.959 | ±0.159 | 1.29 | ±0.028 | 1.73 | ±0.067 | 1.99 | ±0.046 |
| $\mathbf{C_{inter}}$ | nF cm$^{-2}$ | 0.084 | ±1.05 | 0.228 | ±0.163 | 0.658 | ±0.366 | 1.08 | ±0.136 |
| $\mathbf{R_{charge\ tr}}$ | GΩ cm$^2$ | 4.28 | ±0.091 | 4.91 | ±0.065 | 2.6 | ±0.194 | 4.55 | ±0.093 |
| | | | | | | | | | |
| **Time** | hours | **2376** | | **2448** | | **4176** | | **4224** | |
| | | | **error** | | **error** | | **error** | | **error** |
| $\mathbf{R_{sol}}$ | Ω cm$^2$ | 35.3 | ±0.03 | 21.3 | ±0.038 | 21.1 | ±0.042 | 22.1 | ±0.041 |
| $\mathbf{C_{coat}}$ | nF cm$^{-2}$ | 0.851 | ±0.013 | 0.834 | ±0.025 | 1.1 | ±0.016 | 1.15 | ±0.018 |
| $\mathbf{n_{coat}}$ | | 0.969 | ±0.002 | 0.971 | ±0.003 | 0.961 | ±0.002 | 0.956 | ±0.002 |
| $\mathbf{R_{po}}$ | GΩ cm$^2$ | 3.068 | ±0.041 | 2 | ±0.047 | 1.21 | ±0.033 | 1.4 | ±0.053 |
| $\mathbf{C_{inter}}$ | nF cm$^{-2}$ | 1.51 | ±0.102 | 0.729 | ±0.221 | 1.21 | ±0.132 | 1.73 | ±0.2 |
| $\mathbf{R_{charge\ tr}}$ | GΩ cm$^2$ | 4.07 | ±0.074 | 2.51 | ±0.109 | 1.47 | ±0.054 | 1.08 | ±0.098 |

**Table 3. Fitted parameters obtained from the circuit presented in figure 8.a for the epoxy coating with 2-MBT on AA 2024-T3 after 700, 1000, 1272, and 4224 hours in 3.5% NaCl solution.**

| **Time** | hours | **700** | | **1000** | | **1272** | | **4224** | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **error** | | **error** | | **error** | | **error** |
| $\mathbf{R_{sol}}$ | Ω cm$^2$ | 15.2 | ±0.084 | 18 | ±0.133 | 9.01 | ±0.039 | 5.52 | ±0.071 |
| $\mathbf{C_{coat}}$ | nF cm$^{-2}$ | 0.702 | ±0.019 | 0.776 | ±0.02 | 0.836 | ±0.014 | 1.10 | ±0.022 |
| $\mathbf{n_{coat}}$ | | 0.976 | ±0.002 | 0.972 | ±0.002 | 0.968 | ±0.002 | 0.957 | ±0.003 |
| $\mathbf{R_{po}}$ | GΩ cm$^2$ | 0.308 | ±0.023 | 0.266 | ±0.028 | 0.418 | ±0.02 | 0.148 | ±0.031 |
| $\mathbf{C_{inter}}$ | nF cm$^{-2}$ | 5.89 | ±0.046 | 8.43 | ±0.098 | 8.88 | ±0.045 | 8.42 | ±0.111 |
| $\mathbf{R_{charge\ tr}}$ | GΩ cm$^2$ | 0.76 | ±0.029 | 0.231 | ±0.047 | 0.632 | ±0.037 | 0.136 | ±0.051 |

**Table 4. Fitted parameters obtained from the circuit presented in figure 8.a for the epoxy coating containing PMAA@$CeO_2$ nanocontainers loaded with 2-MBT on AA 2024-T3 after 312, 432, 1000, 1272, 2376 and 2448 hours in 3.5% NaCl solution.**

| **Time** | hours | **312** | | **432** | | **1000** | | **1272** | | **2376** | | **2448** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **error** | | **error** | | **error** | | **error** | | **error** | | **error** |
| $\mathbf{R_{sol}}$ | Ω cm$^2$ | 27.2 | ±0.048 | 29.7 | ±0.075 | 16.2 | ±0.047 | 17.9 | ±0.056 | 19.2 | ±0.07 | 16.1 | ±0.034 |
| $\mathbf{C_{coat}}$ | nF cm$^{-2}$ | 0.58 | ±0.013 | 0.595 | ±0.017 | 0.684 | ±0.016 | 0.929 | ±0.017 | 0.845 | ±0.013 | 0.88 | ±0.02 |
| $\mathbf{n_{coat}}$ | | 0.975 | ±0.002 | 0.974 | ±0.002 | 0.97 | ±0.002 | 0.942 | ±0.002 | 0.958 | ±0.002 | 0.956 | ±0.002 |
| $\mathbf{R_{po}}$ | GΩ cm$^2$ | 0.648 | ±0.024 | 0.867 | ±0.031 | 0.55 | ±0.027 | 0.77 | ±0.03 | 0.64 | ±0.027 | 0.678 | ±0.059 |
| $\mathbf{C_{inter}}$ | nF cm$^{-2}$ | 6.14 | ±0.094 | 3.72 | ±0.102 | 3.29 | ±0.092 | 5.69 | ±0.113 | 2.13 | ±0.077 | 1.98 | ±0.074 |
| $\mathbf{R_{charge\ tr}}$ | GΩ cm$^2$ | 0.394 | ±0.046 | 0.769 | ±0.043 | 0.579 | ±0.054 | 0.677 | ±0.061 | 0.947 | ±0.05 | 0.394 | ±0.046 |

**Table 5. Fitted parameters obtained from the circuit presented in figure 8.b for the scribed epoxy coating without any inhibitor on AA 2024-T3 after 24, 48 and 72 hours in 3.5% NaCl solution.**

| **Time** | hours | **24** | | **48** | | **72** | |
|---|---|---|---|---|---|---|---|
| | | | **error** | | **error** | | **error** |
| $\mathbf{R_{sol}}$ | $\Omega$ cm$^2$ | 26.4 | fixed | 26.4 | fixed | 26.4 | fixed |
| $\mathbf{C_{coat}}$ | nF cm$^{-2}$ | 50.3 | fixed | 297 | fixed | 309 | fixed |
| $\mathbf{n_{coat}}$ | | 0.908 | fixed | 0.717 | fixed | 0.713 | fixed |
| $\mathbf{R_{po}}$ | G$\Omega$ cm$^2$ | 0.959 | fixed | 0.959 | fixed | 0.959 | fixed |
| $\mathbf{C_{coat\ inter}}$ | nF cm$^{-2}$ | $8.38\times10^{-2}$ | fixed | $8.38\times10^{-2}$ | fixed | $8.38\times10^{-2}$ | fixed |
| $\mathbf{R_{charge\ tr\ unscribed}}$ | G$\Omega$ cm$^2$ | 4.28 | fixed | 4.28 | fixed | 4.28 | fixed |
| $\mathbf{R_{sol\ scr}}$ | $\Omega$ cm$^2$ | 74.769 | ±0.105 | 85.223 | ±0.051 | 93.208 | ±0.039 |
| $\mathbf{R_{corr\ pr}}$ | $\Omega$ cm$^2$ | 416.41 | ±0.845 | 4441.9 | ±0.226 | 5559 | ±0.149 |
| $\mathbf{C_{oxide}}$ | $\mu$F cm$^{-2}$ | 1.06 | ±1.28 | 4.20 | ±0.158 | 5.25 | ±0.104 |
| $\mathbf{n_{oxide}}$ | | 0.908 | ±0.13 | 0.825 | ±0.02 | 0.815 | ±0.014 |
| $\mathbf{C_{dl}}$ | $\mu$F cm$^{-2}$ | 1.04 | ±1.27 | 6.99 | ±0.4 | 0.794 | ±0.273 |
| $\mathbf{n_{dl}}$ | | 0.881 | ±0.11 | 1.03 | ±0.06 | 1.09 | ±0.043 |
| $\mathbf{R_{pol}}$ | k$\Omega$ cm$^2$ | 69.4 | ±0.025 | 47.9 | ±0.022 | 66.2 | ±0.023 |
| $\mathbf{W_s}$**-R** | k$\Omega$ cm$^2$ | 470 | ±2.92 | 34.2 | ±0.089 | 44.4 | ±0.09 |
| $\mathbf{W_s}$**-T** | sec$^{-1}$ | 565 | ±5.71 | 28 | ±0.104 | 32.9 | ±0.116 |
| $\mathbf{W_s}$**-PHI** | | 0.519 | ±0.042 | 0.602 | ±0.047 | 0.552 | ±0.058 |

**Table 6. Fitted parameters obtained from the circuit presented in figure 8.b for the scribed epoxy coating containing PMAA@$CeO_2$ nanocontainers loaded with 2-MBT on AA 2024-T3 after 24, 48 and 72 hours in 3.5% NaCl solution.**

| **Time** | hours | **24** | | **48** | | **72** | |
|---|---|---|---|---|---|---|---|
| | | | **error** | | **error** | | **error** |
| $\mathbf{R_{sol}}$ | Ω cm$^2$ | 26.4 | fixed | 26.4 | fixed | 26.4 | fixed |
| $\mathbf{C_{coat}}$ | nF cm$^{-2}$ | 89.3 | fixed | 102 | fixed | 125 | fixed |
| $\mathbf{n_{coat}}$ | | 0.812 | fixed | 0.79 | fixed | 0.758 | fixed |
| $\mathbf{R_{po}}$ | GΩ cm$^2$ | 0.959 | fixed | 0.959 | fixed | 0.959 | fixed |
| $\mathbf{C_{coat\ inter}}$ | nF cm$^{-2}$ | $8.38\times10^{-2}$ | fixed | $8.38\times10^{-2}$ | fixed | $8.38\times10^{-2}$ | fixed |
| $\mathbf{R_{charge\ tr\ unscribed}}$ | GΩ cm$^2$ | 4.28 | fixed | 4.28 | fixed | 4.28 | fixed |
| $\mathbf{R_{sol\ scr}}$ | Ω cm$^2$ | 89.7 | ±0.121 | 92.2 | ±0.066 | 101 | ±0.056 |
| $\mathbf{R_{corr\ pr}}$ | Ω cm$^2$ | 191 | ±0.392 | 260 | ±0.245 | 288 | ±0.223 |
| $\mathbf{C_{oxide}}$ | µF cm$^{-2}$ | 0.64 | ±1.41 | 0.963 | ±0.743 | 1.23 | ±0.648 |
| $\mathbf{n_{oxide}}$ | | 0.951 | ±0.14 | 0.945 | ±0.078 | 0.937 | ±0.07 |
| $\mathbf{C_{dl}}$ | µF cm$^{-2}$ | 1.25 | ±0.598 | 1.60 | ±0.367 | 1.93 | ±0.332 |
| $\mathbf{n_{dl}}$ | | 0.947 | ±0.053 | 0.953 | ±0.035 | 0.954 | ±0.032 |
| $\mathbf{R_{pol}}$ | kΩ cm$^2$ | 117 | ±0.044 | 146 | ±0.04 | 151 | ±0.061 |
| $\mathbf{W_s}$**-R** | kΩ cm$^2$ | 1439 | ±0.04 | 641 | ±0.037 | 514 | ±0.054 |
| $\mathbf{W_s}$**-T** | sec$^{-1}$ | 69.4 | ±0.058 | 44.9 | ±0.065 | 52.1 | ±0.112 |
| $\mathbf{W_s}$**-PHI** | | 0.59 | ±0.012 | 0.533 | ±0.02 | 0.454 | ±0.035 |