Electronic Supplementary Material (ESI) for RSC Advances

Section S1:

Ionic Efficiency

The ionic efficiency (ξ_i) during anodization was calculated by correlating the wire radius from charge measurements to that from resistance measurements as shown in equations (1) and (2)

$$r_Q(t) = \sqrt{r_{init}^2 - \frac{\xi_i Q(t) Molwt(Al)}{zF\rho_{Al}\pi L}} \qquad (1)$$

$$\Delta R = \frac{\rho L}{\pi}\left(\frac{1}{r_\Omega(t_2)^2} - \frac{1}{r_\Omega(t_1)^2}\right) \qquad (2)$$

When ξ_i is 0.8, a good correlation is obtained between $r_Q(t)$ – the radius of the remaining Al determined using charged passed and $r_\Omega(t)$ – the radius determined using resistance measurements. The value of ξ_i = 0.8 is near constant across all three anodization voltages. Fig. S1 shows that the fect correlation between the wire radius through charge and resistance measurements using the calculated ξ_i of 0.8.

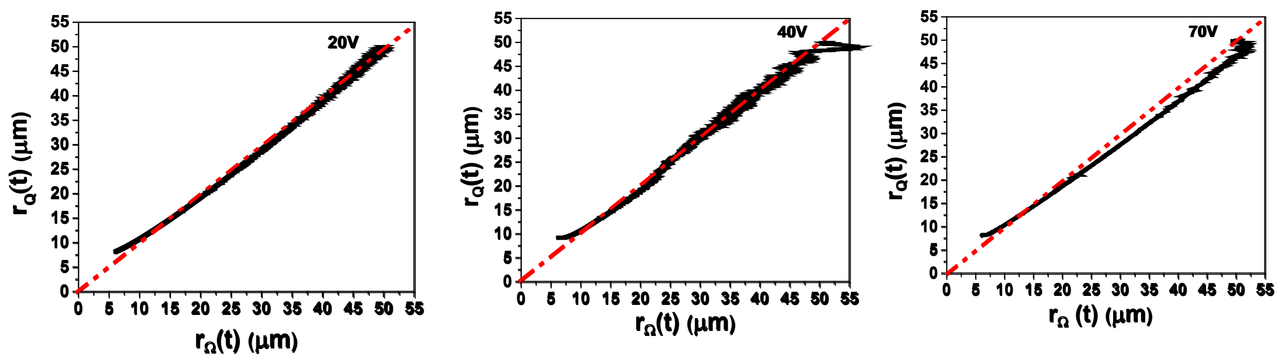

Fig S1: The bold line shows the correlation between the wire radius calculated from resistance measurements($r_\Omega(t)$) and that from charge measurements($r_Q(t)$) using an ionic efficiency of 0.8.The dotted line shows the linear for a perfect correlation.

Section S2:

Calculation of error in ICP-OES due to electrolyte replenishment

Volume of electrolyte = 688ml

At time, 't', 12ml of the electrolyte is withdrawn for ICP-OES.

Measured concentration of Al^{3+} in electrolyte at time 't'(ICP-OES) = c_t g/ml

The electrolyte is then replenished by 12ml of fresh electrolyte to bring the volume back to 688ml

New concentration after replenishment at time't'= $(688c_t-12c_t)/688=0.983c_t$

Relative change in concentration after replenishment (%)=1.7