Ultimately, the use of light-weight, high load-bearing, high thermal stability materials requires high mechanical strength 1D ceramic NWs over conventional 0D nanoparticles. However, the synthesis of ceramic 1D materials embraces outstanding challenges with a use of complicated reaction techniques. Here, we demonstrate the technology of the de-alloying of bulk Al-Li alloys in alcohols at moderate reaction conditions which gives ultra-long aluminum ethoxide metal-organic nanowires, which are further converted on heating to the mechanically robust aluminum oxide ceramic nanowires. We demonstrate the crucial parameters of controllable growth of the metal-organic NWs, such as composition of the alloy, molecular structure of the NWs, and the strain energy minimization of alloy grains at the reactive interface. We also show the cost-effective condition of the metal-organic alkoxide NWs synthesis by reducing the content of Li metal in alloy from 20 to 5wt.%. By utilizing the solution and solid-state nuclear magnetic resonance, we provide sufficient characterization rigor of the molecular structure of the metal-organic NWs. The conditions of the transformation of metal-organic NWs to oxide ceramic NWs and the microstructure of ceramic oxide NWs, which influence their mechanical properties will be additionally discussed. Additionally, we will demonstrate the technology of the replacement of conventional polymer separators for Li-ion batteries (LIBs) by thermally stable, flexible, and wettable binder-free Al₂O₃ NWs fabric. The potential of this technology, which is feasible in its nature and excels any reported synthesis of ceramic oxide nanowires, is tremendous and is capable to satisfy the demands for the thin separators in automotive LIBs without sacrifice of their mechanical properties.


**Keywords:** nanowires, ceramic, separator

**Acknowledgment:**

This work was supported by Sila Nanotechnologies Inc. G.Y. is a shareholder of Sila.

**Presenting author's email:** kostiantyn.turcheniuk@mse.gatech.edu