ADVANCED FUNCTIONAL MATERIALS

Supporting Information

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The Bottom Up Approach is Not Always the Best Processing Method: Dense α-Al_2O_3 /$NiAl_2O_4$ Composites

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Supporting Information

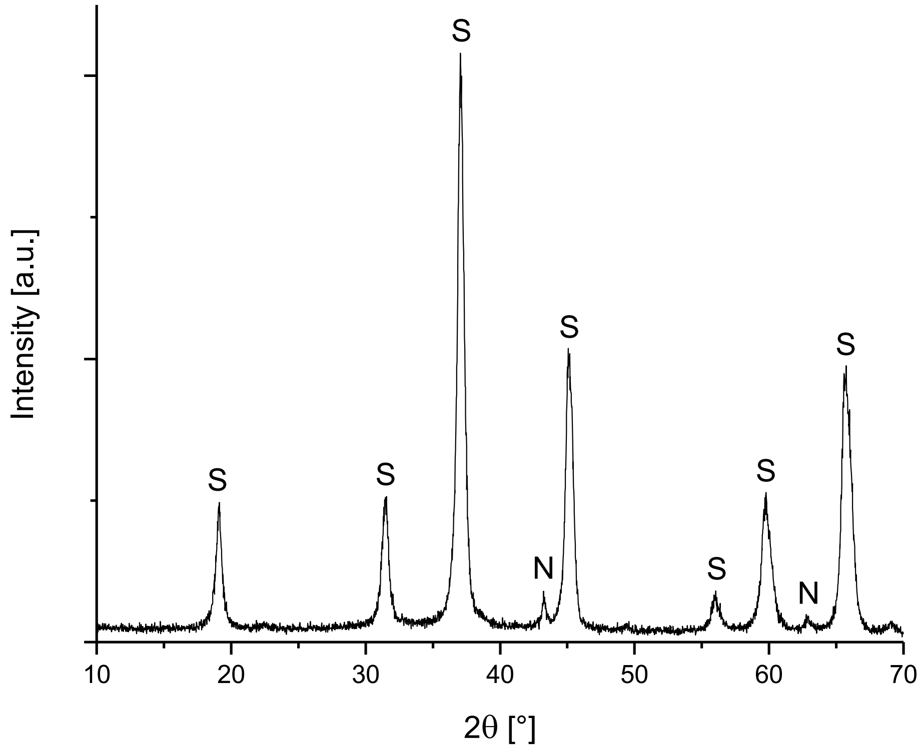

Figure S1. XRD pattern for LF-FSP $NiAl_2O_4$. The $NiAl_2O_4$ spinel phase is denoted by S, and NiO is denoted by N. A small amount of bunsenite (NiO) is present, but as previously noted, the sample fully transforms to $NiAl_2O_4$ at high temperatures.

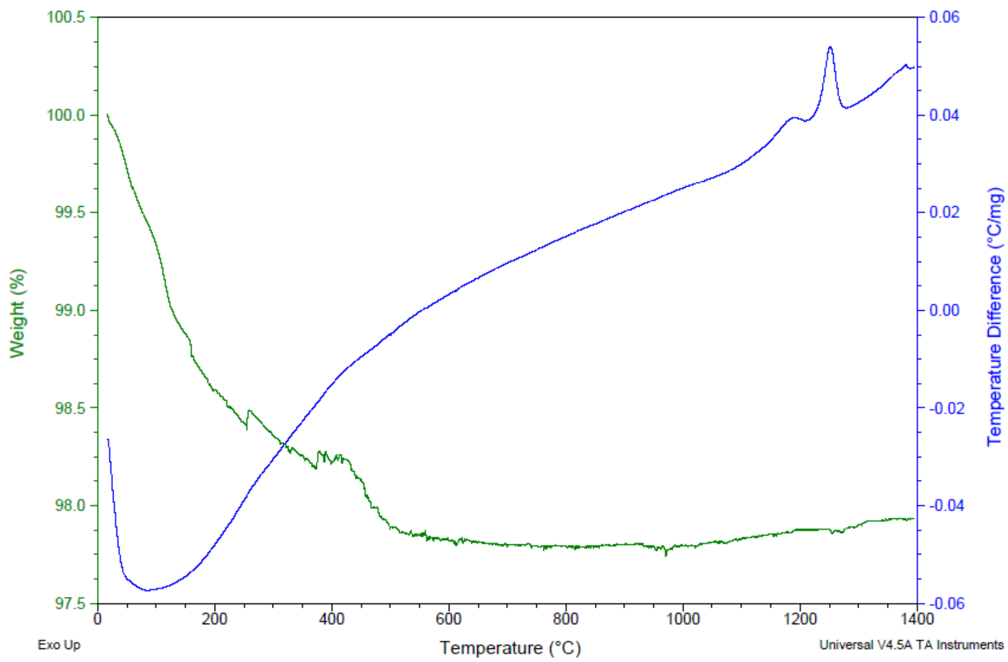

Figure S2. TGA/DTA for Nanotek Al_2O_3. DTA shows an exotherm corresponding to α-Al_2O_3 phase nucleation at 1250° C, and a smaller exotherm around 1150° C corresponding to Θ-Al_2O_3 phase transformation. TGA mass loss around 2.1 wt%.

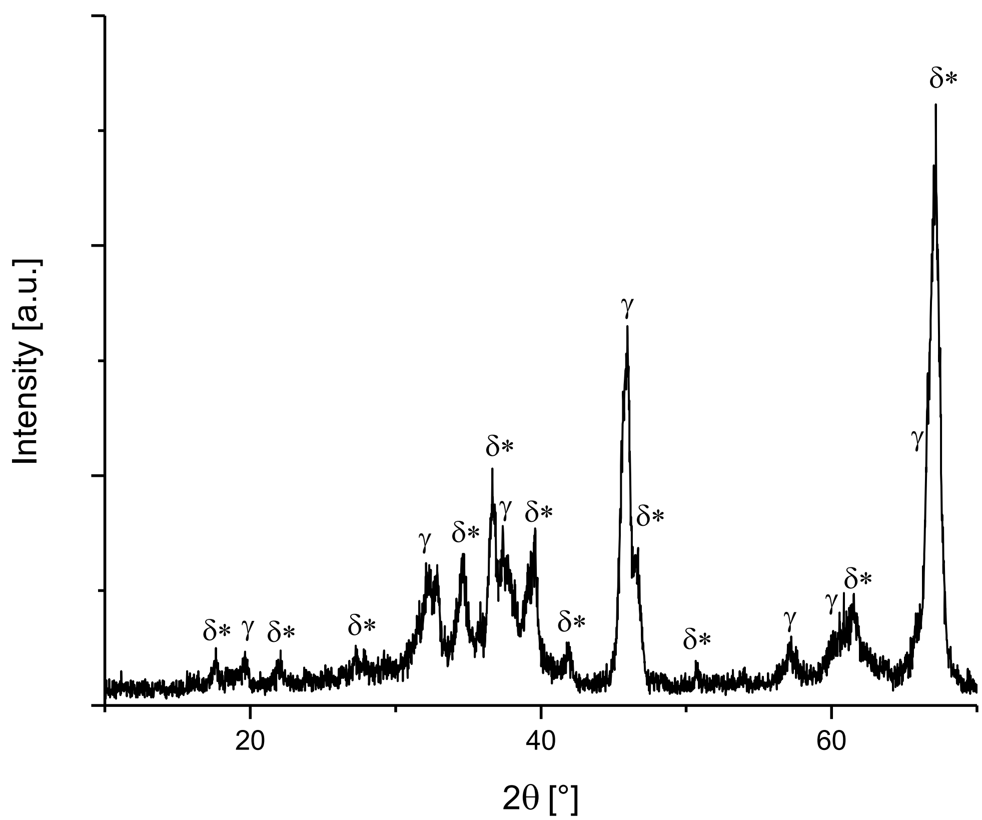

Figure S3. X-ray diffraction pattern for Nanotek Al_2O_3. Sample is mostly δ-Al_2O_3 and δ*-Al_2O_3. No α-Al_2O_3 is present. (δ*-Al_2O_3 PDF# 00-046-1215, δ-Al_2O_3 PDF# 00-046-1131, γ-Al_2O_3 PDF# 00-050-0741)

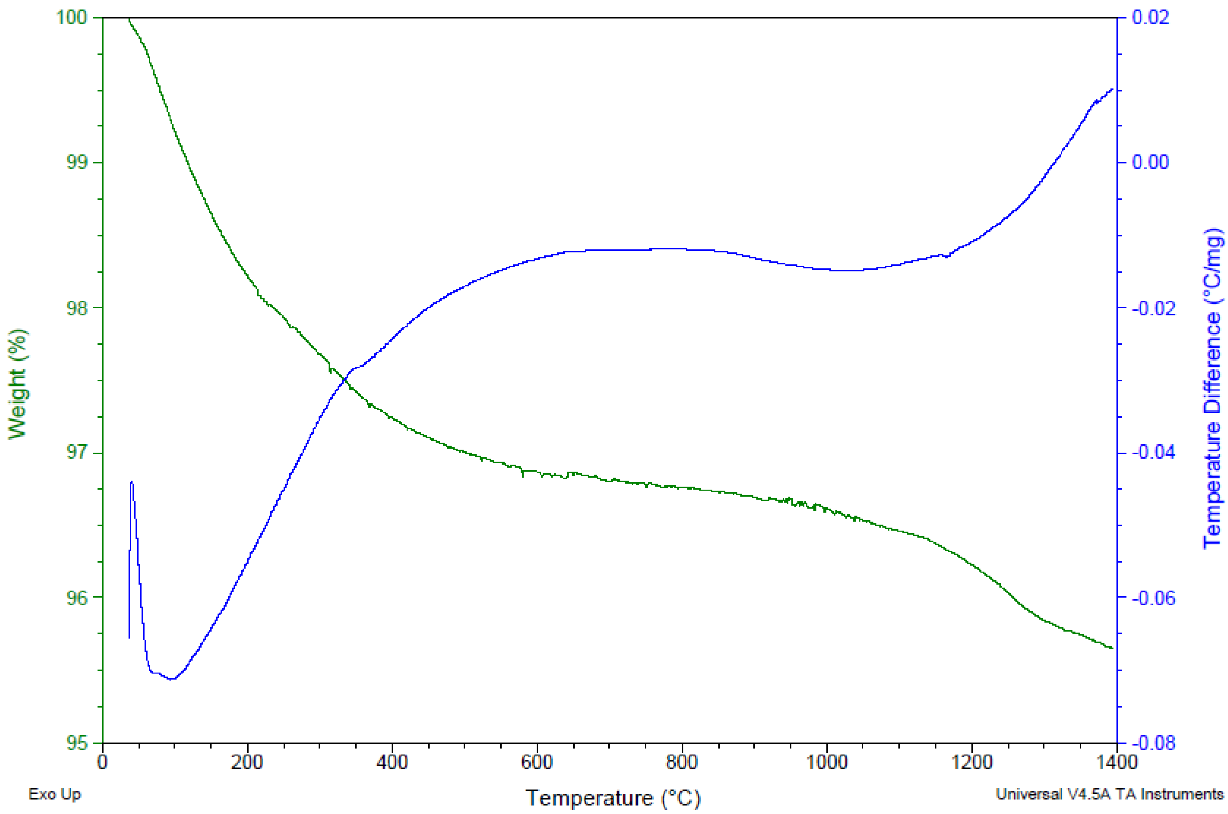

Figure S4. TGA/DTA for as-produced LF-FSP $NiAl_2O_4$. TGA mass loss 3.3 wt% at 1000° C. No discernible DTA events are observable. Mass loss above 1000° C may be to Ni volatility.

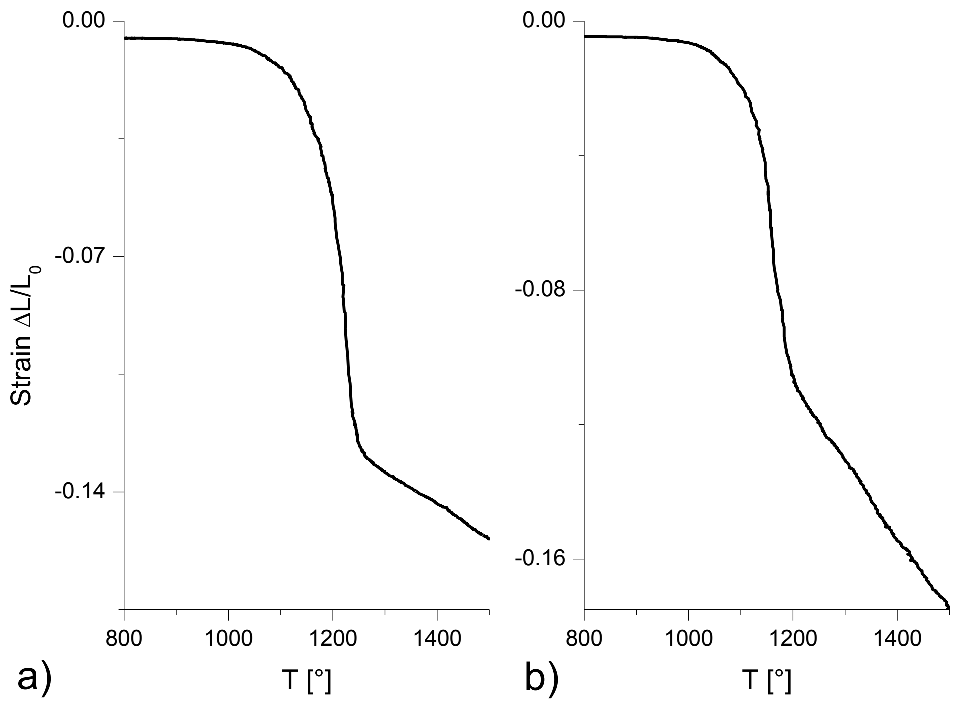

Figure S5. a) Dilatometry trace of $NiO \cdot 3Al_2O_3$, ramp rate 10° C/min/air Al_2O_3 rich $NiAl_2O_4$. The dilatometry curve has a quicker onset of densification, but looks quite similar to the ball milled sample, including the two separate densification rates. b) Dilatometry trace of $NiAl_2O_4$ + Al_2O_3, ramp rate 10° C/min/air. Significant densification begins around 1150° C, with a second slower densification mechanism beginning around 1250° C.