

Supporting Information

Title: Reactive intermediate phase cold sintering in strontium titanate

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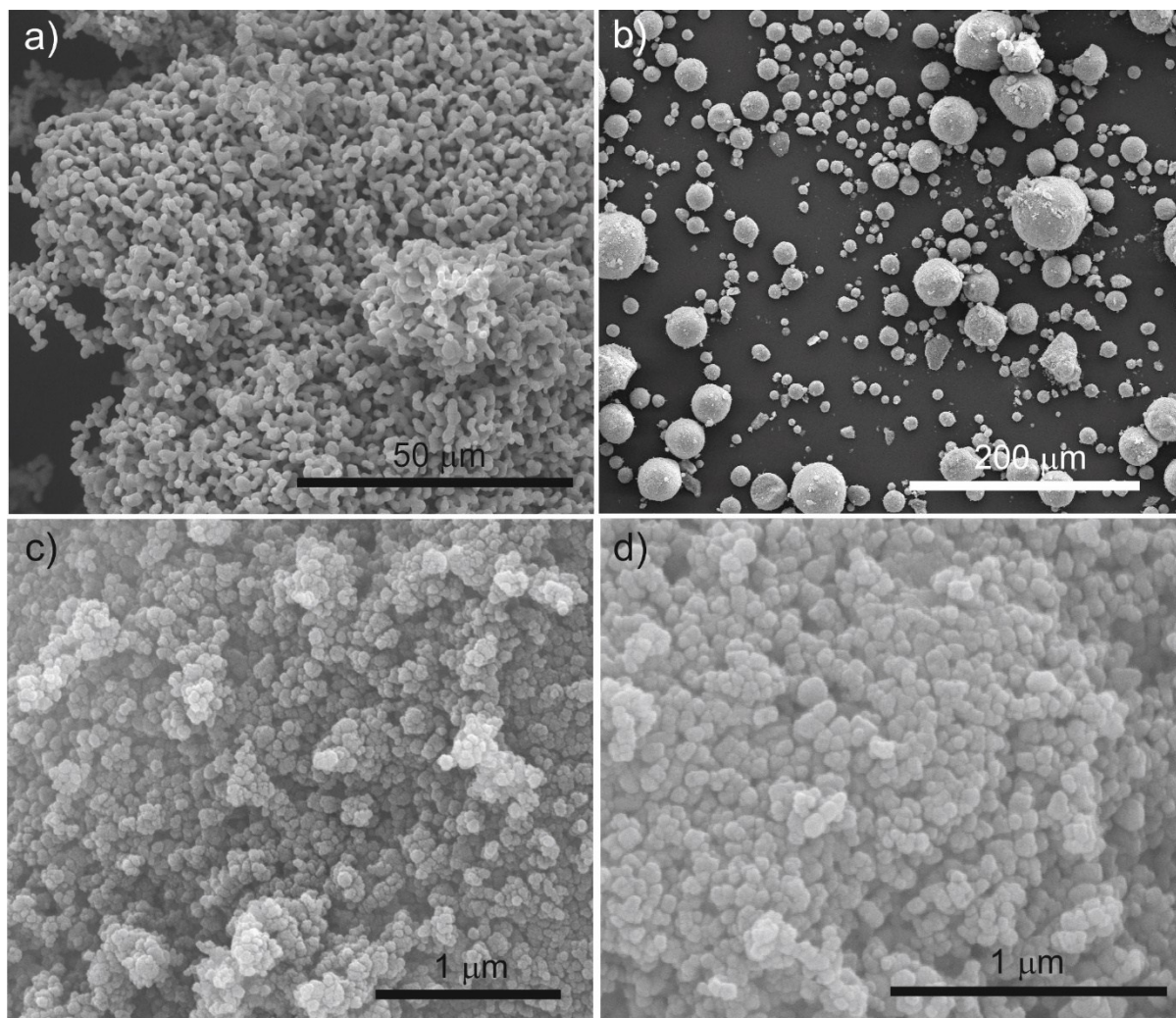


Figure S1. SEM micrographs of a) the in-house-synthesised solid state SrTiO₃ b) the as-received SrTiO₃ nanopowder which was agglomerated into large particles, c) a higher-magnification image of the SrTiO₃ nanopowder showing the crystallite size, and d) the as-received TiO₂ powder.

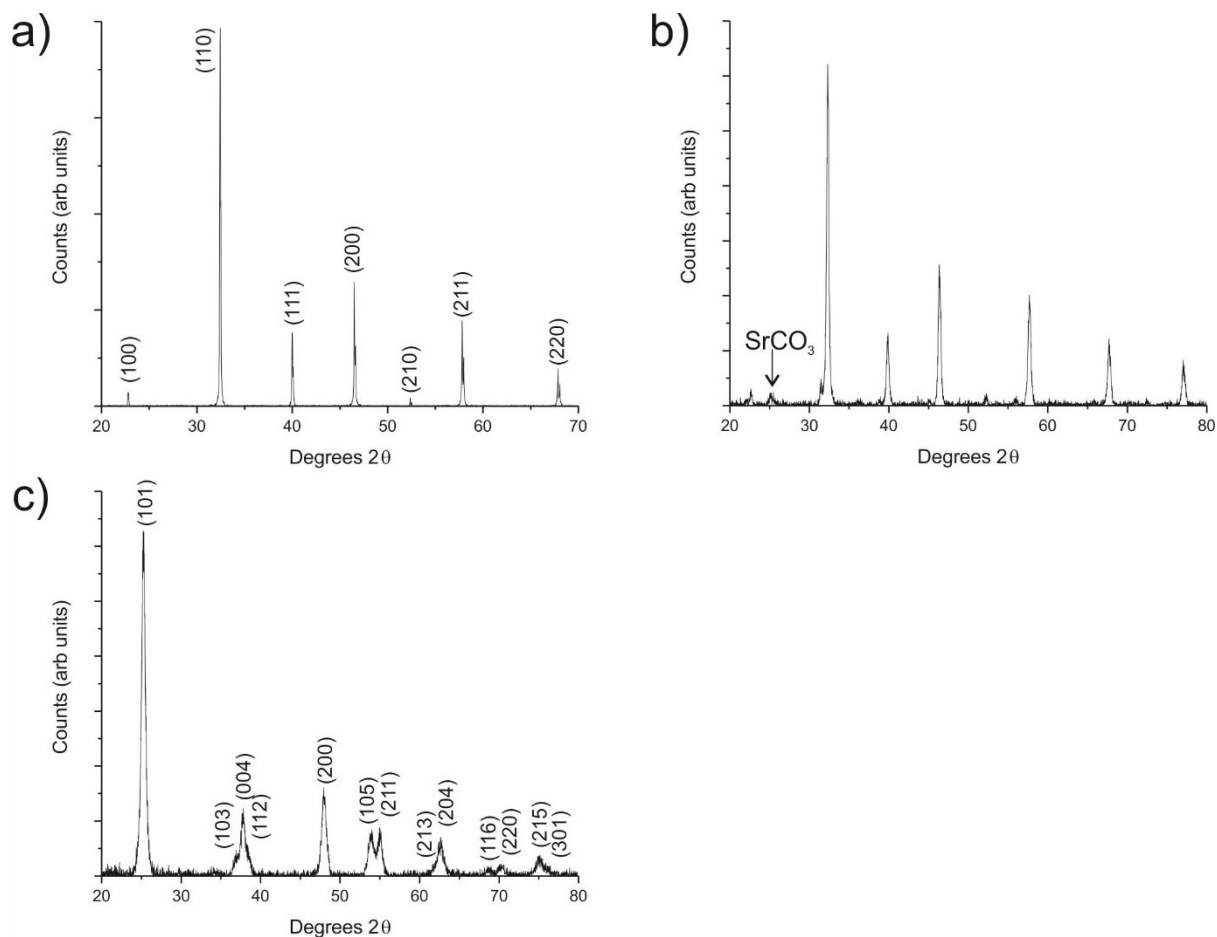


Figure S2. XRD patterns of a) the in house-produced solid state SrTiO_3 starting powder indexed to a cubic cell, b) the as-received nano- SrTiO_3 powder which contains some SrCO_3 phase, and c) the as- received nano TiO_2 powder which showed significant peak broadening due to the particle size.

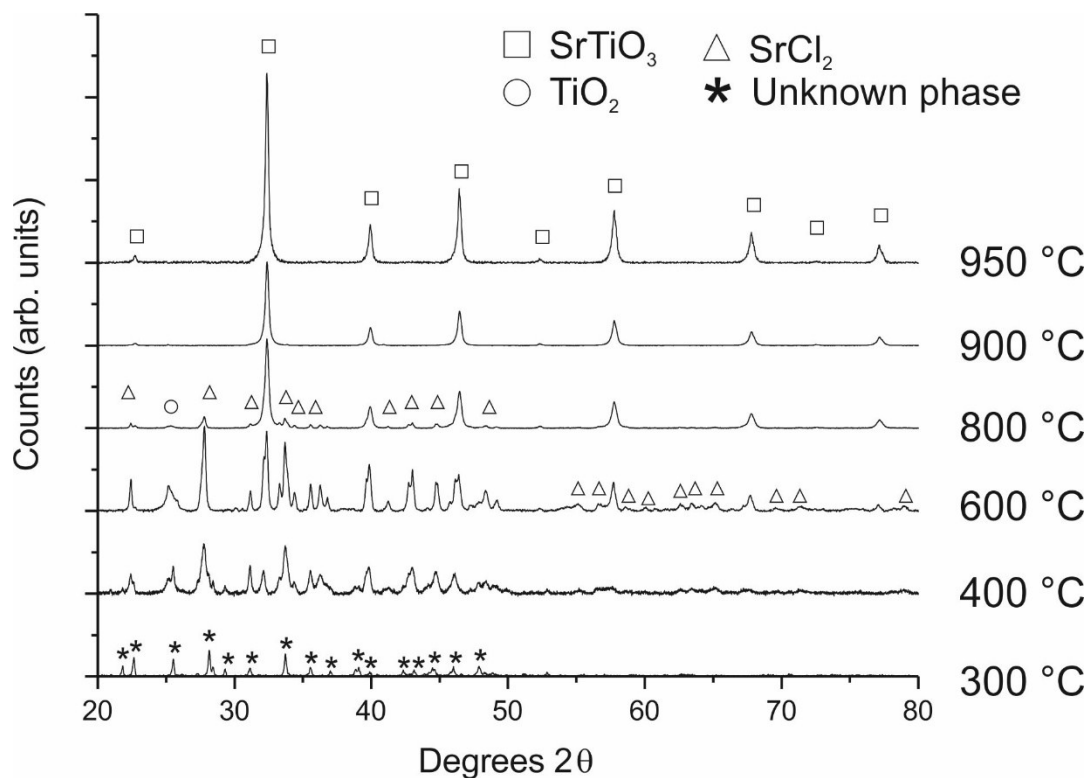


Figure S3. XRD of deep eutectic solvent-synthesised powders calcined at different temperatures. An unknown phase is present below 400 °C, possibly a titanium-organic complex. By 400 °C, this is reacted to form strontium chloride and titanium dioxide, which persist until 900 °C. At 600 °C, the first indication of SrTiO₃ is observed. By 950 °C, the intermediate phases have reacted to produce phase pure strontium titanate.

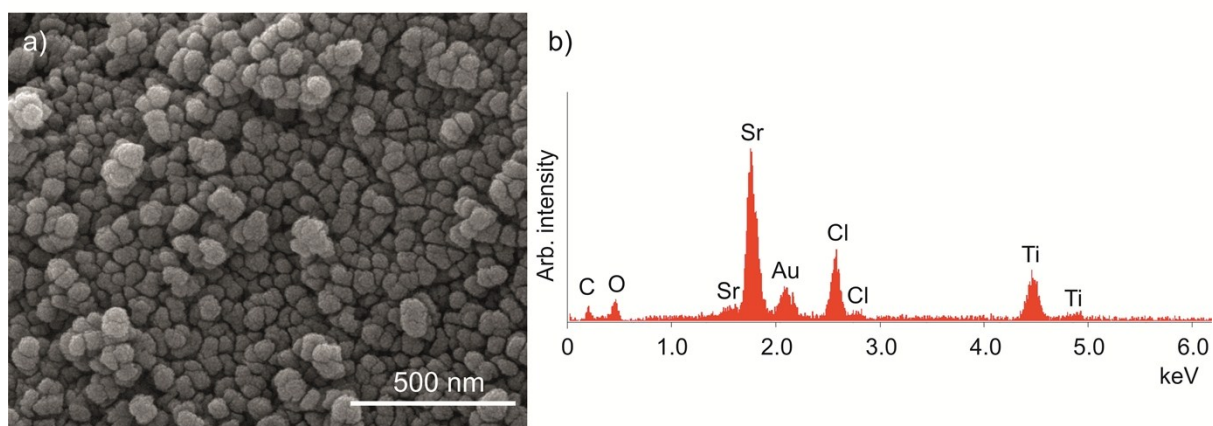


Figure S4. a) SEM and b) corresponding EDXA of a nanopowder ceramic which has been undergone the heated pressing step but has not been heated to 950 °C. The EDXA demonstrates the presence of chlorine (as crystalline strontium chloride) which is later lost in the post-press heating step.

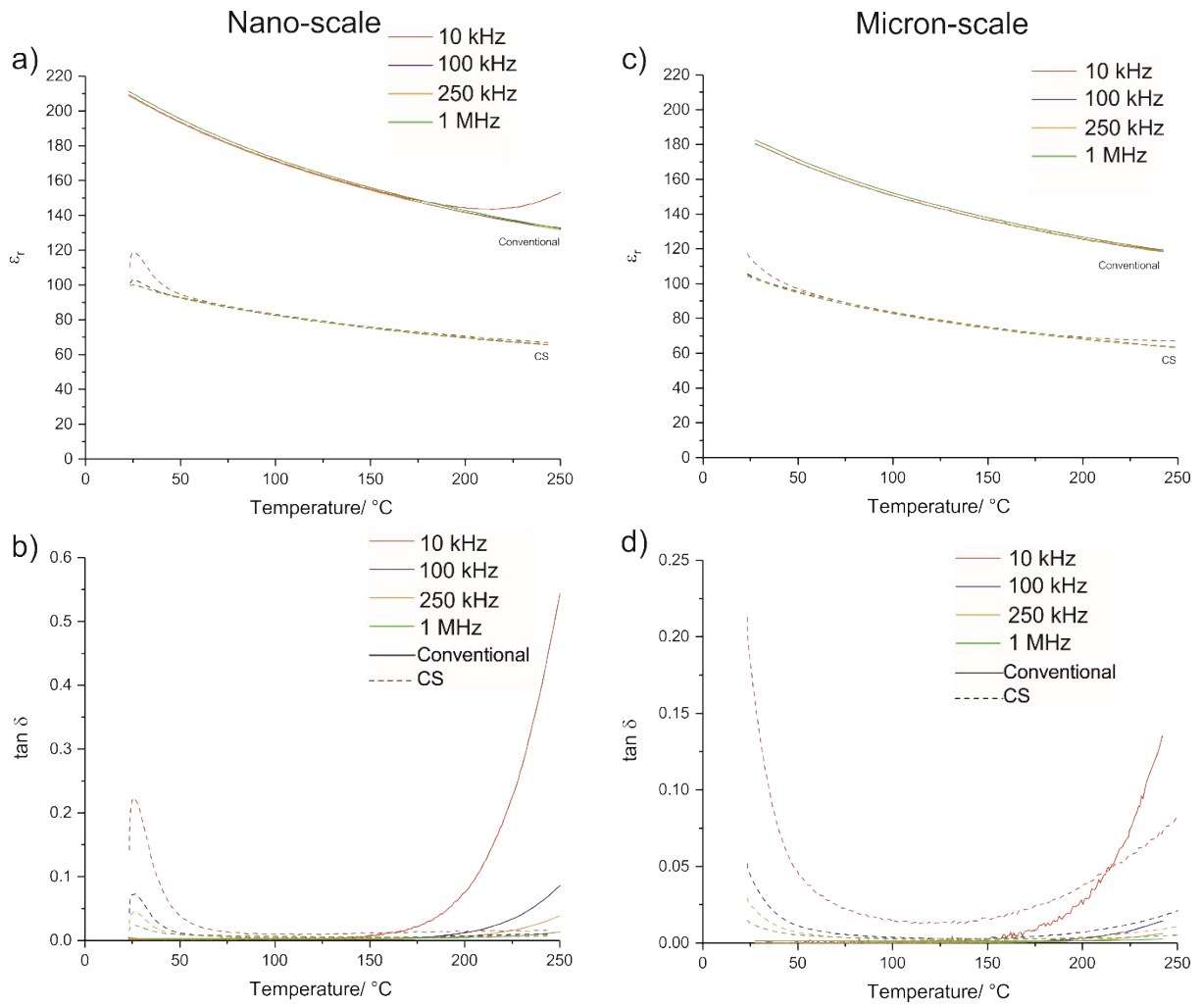


Figure S5. Relative permittivity and loss tangent data for a) and b) nanoscale samples sintered using CS and conventional processes (1400 $^{\circ}\text{C}$, 6h) and c) and d) microscale samples.