

Figure 1. Applied voltage and imposed current vs time for pre-sintered specimen at a furnace temperature of 934 °C. Inset: second transient on expanded scale.

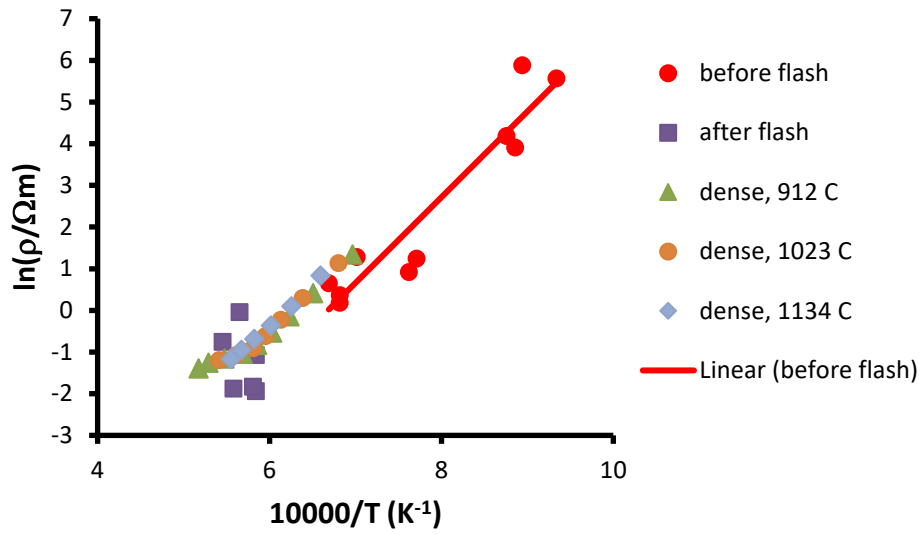


Figure 2. Inverse Arrhenius plot for temperature dependence of resistivity.

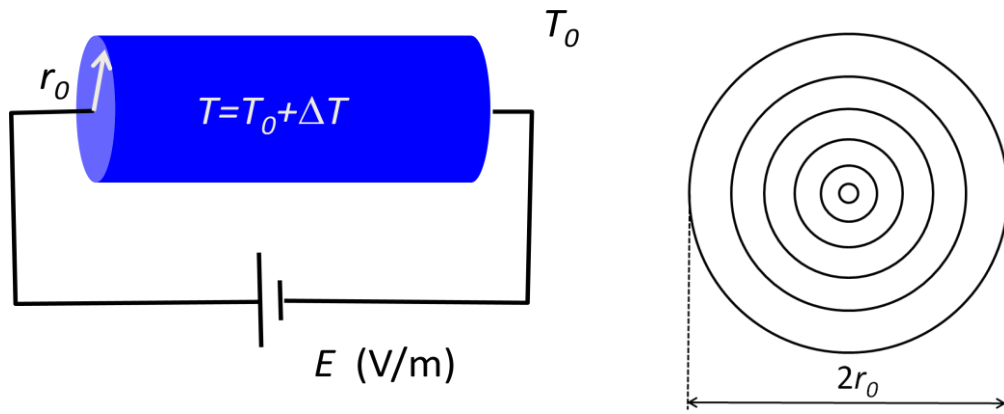
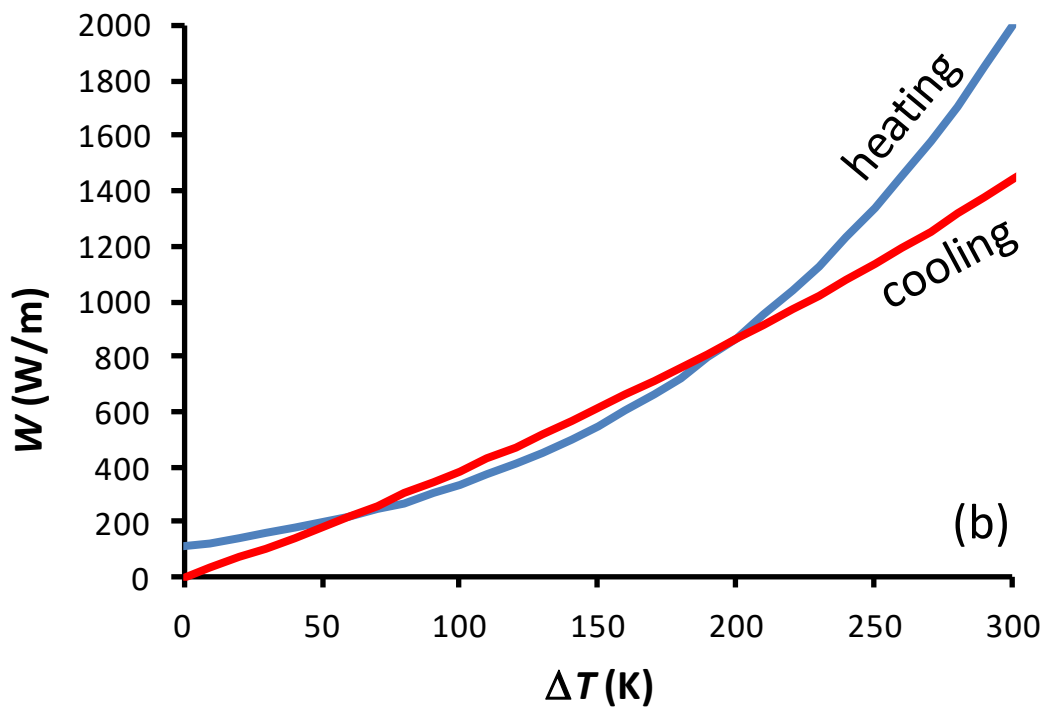
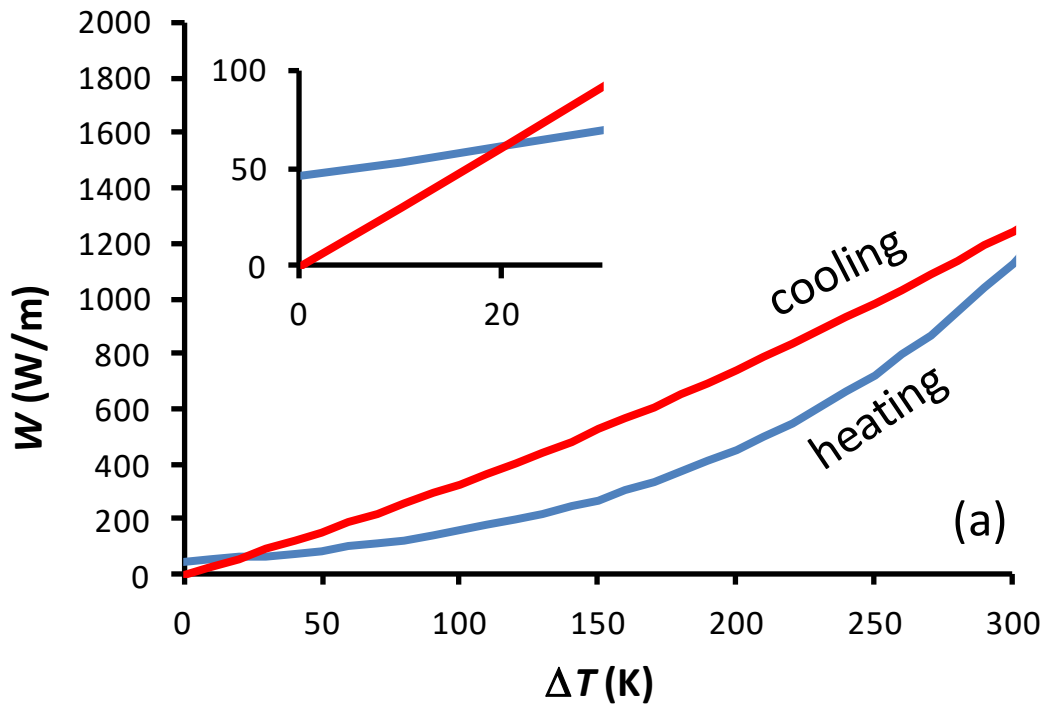


Figure 3. (a) Schematic of SU model. (b) Schematic of cross-section for DNU model.



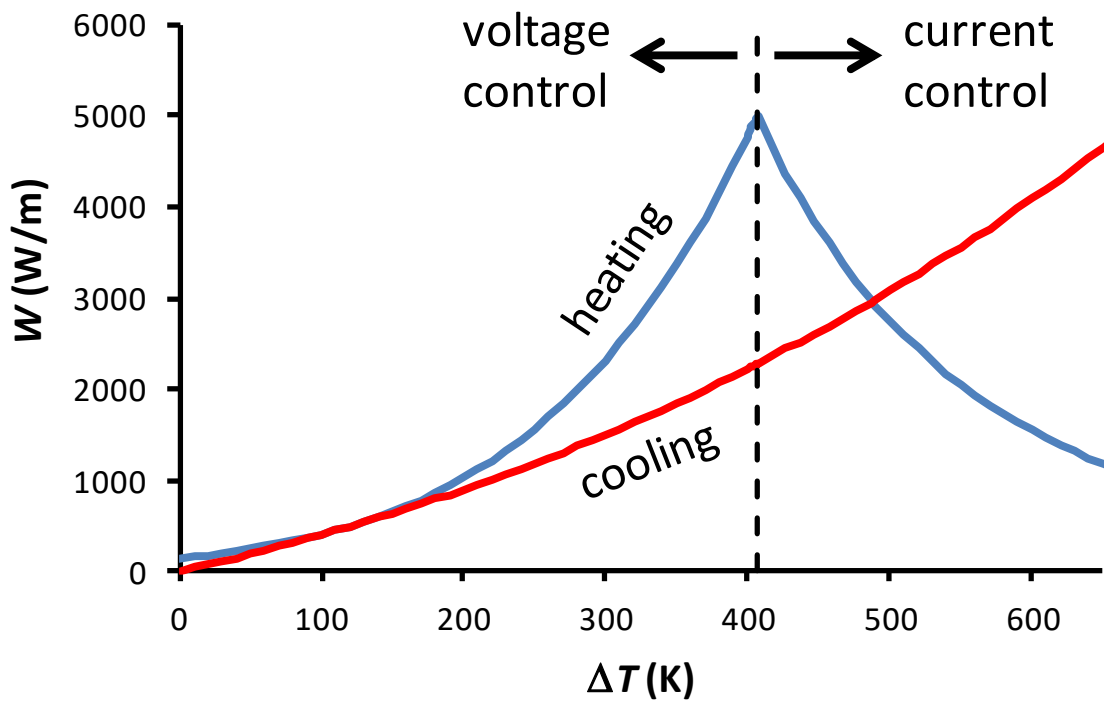
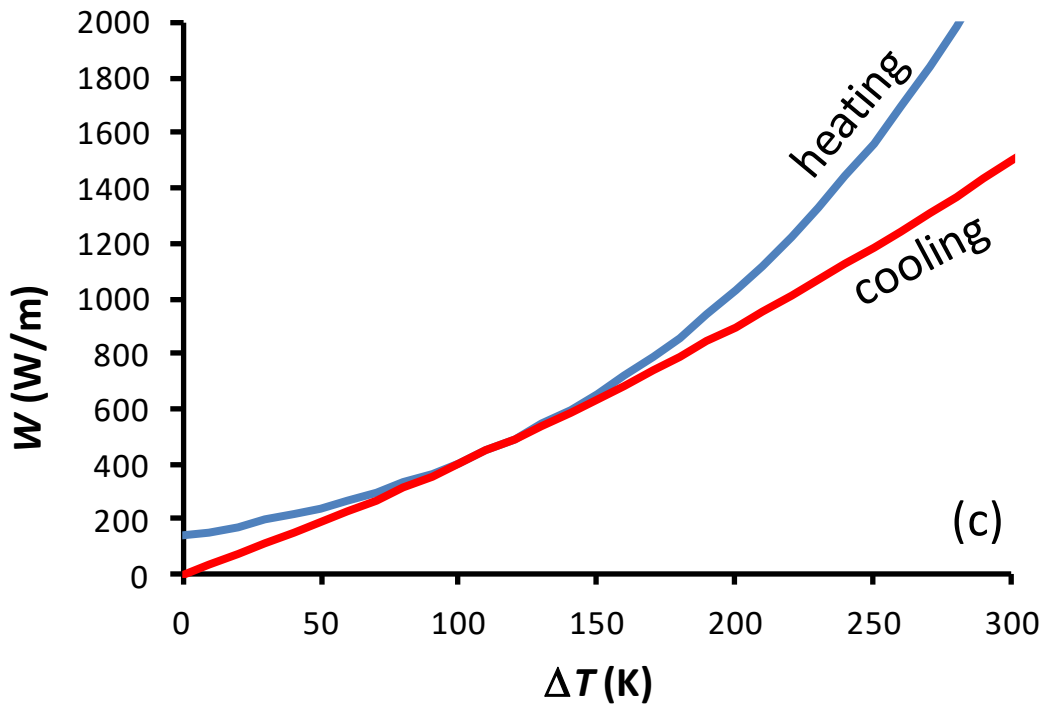


Figure 4. SU model comparison of Joule heating and radiative cooling as function of excess specimen temperature ΔT for an electric field of 100 V/cm, specimen dimensions as given in the text and three different furnace temperature, T_0 : (a) 1250 K (b) 1320 K (c) 1339 K. (d) Initial conditions as for (c), switching to current control at 0.5 A.

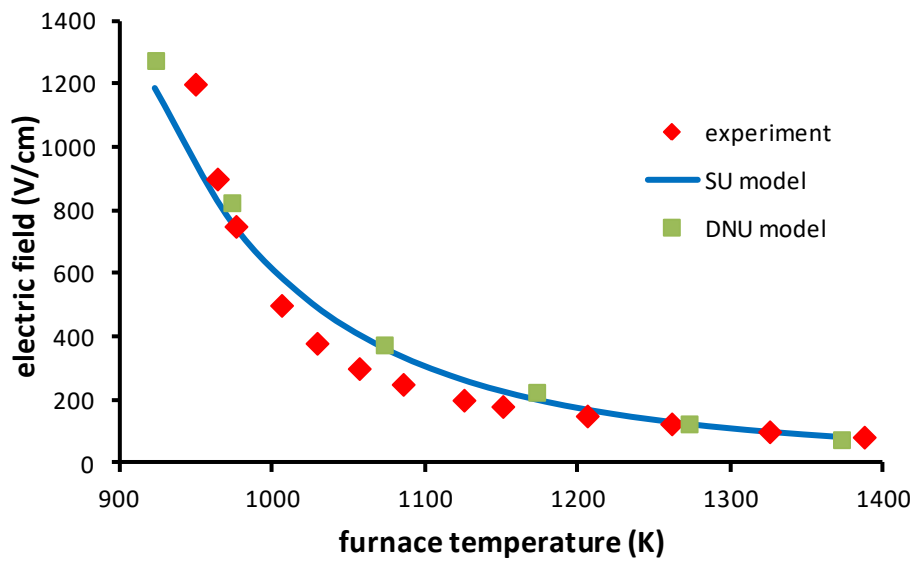
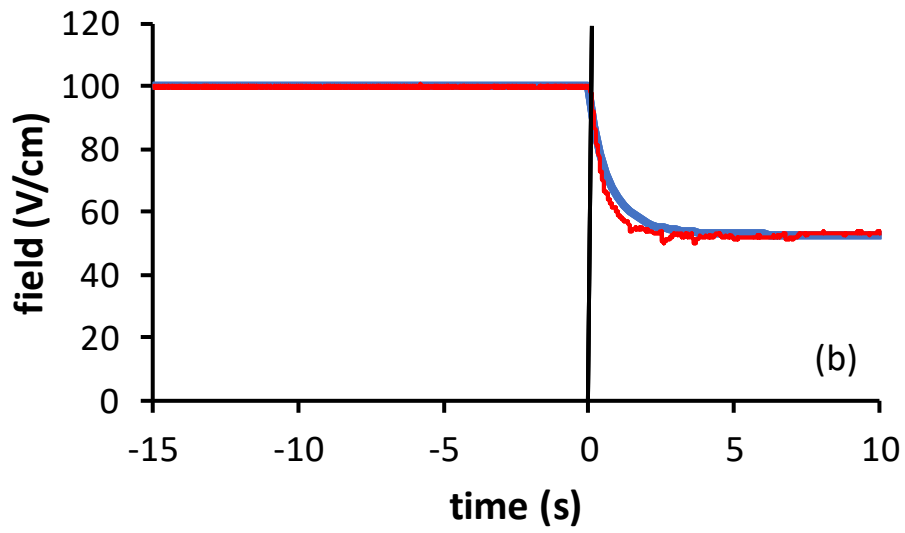
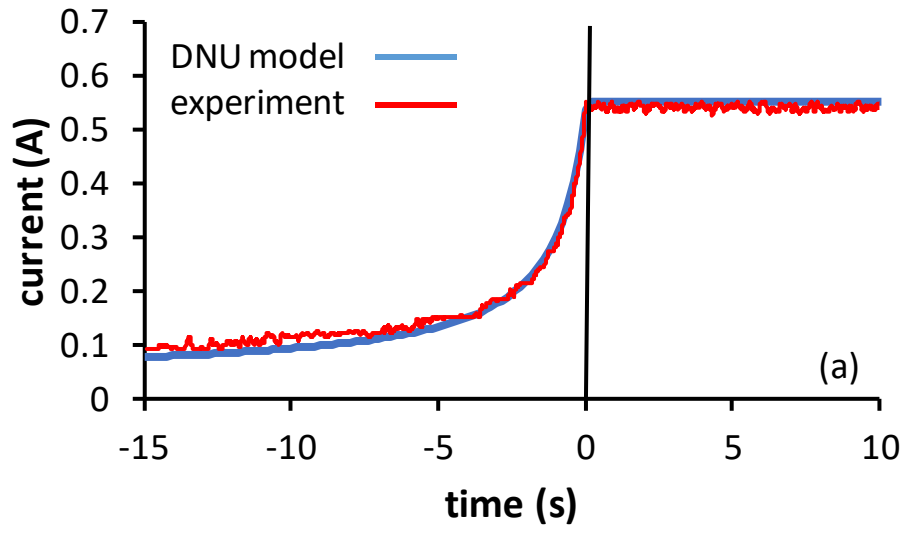


Figure 5. Comparison of applied electric field E_{crit} at which the flash event occurs versus furnace temperature relationship for the experiment and the two models.



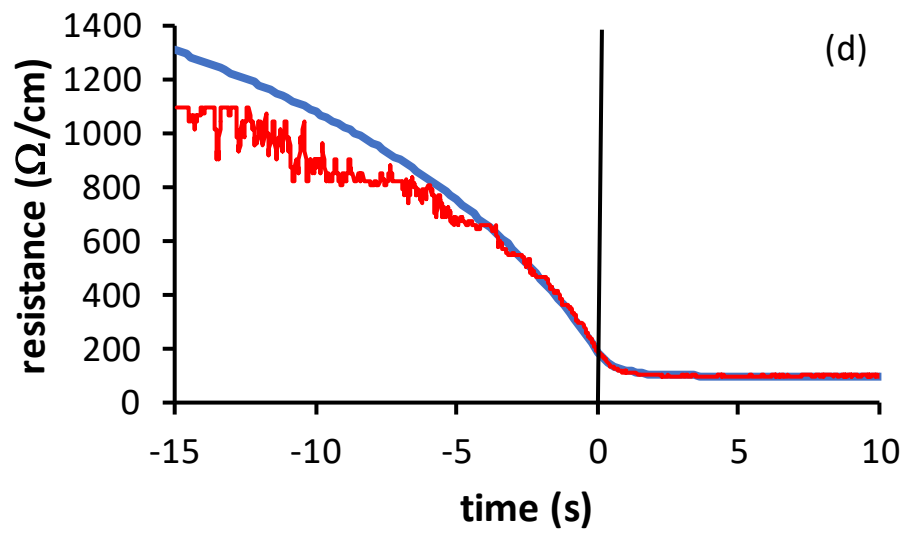
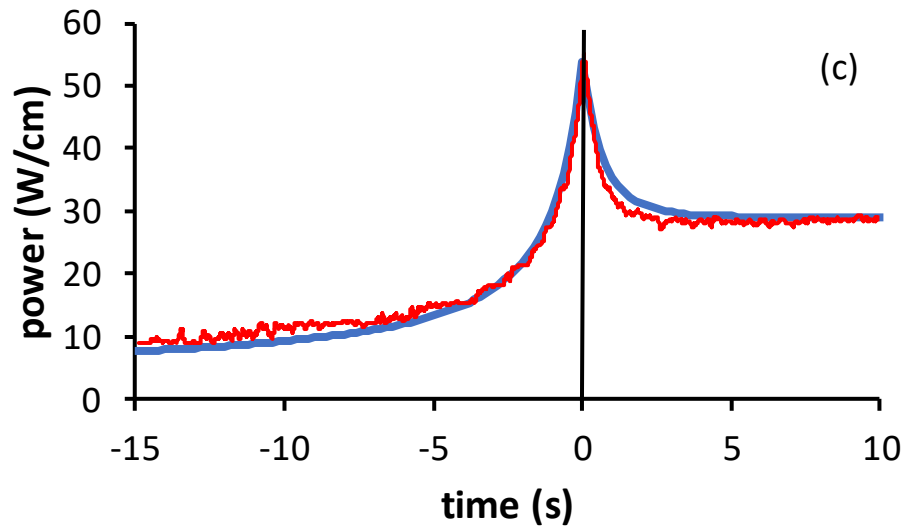


Figure 6. (a) Current, (b) electric field, (c) power and (d) resistance against time for experiment and DNU model prediction with an initial field of 100 V/cm and a current limit of 0.55 A.

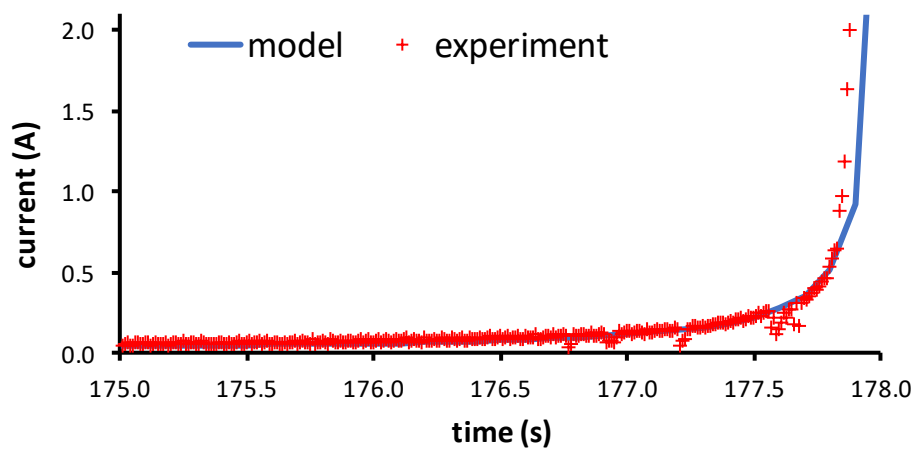
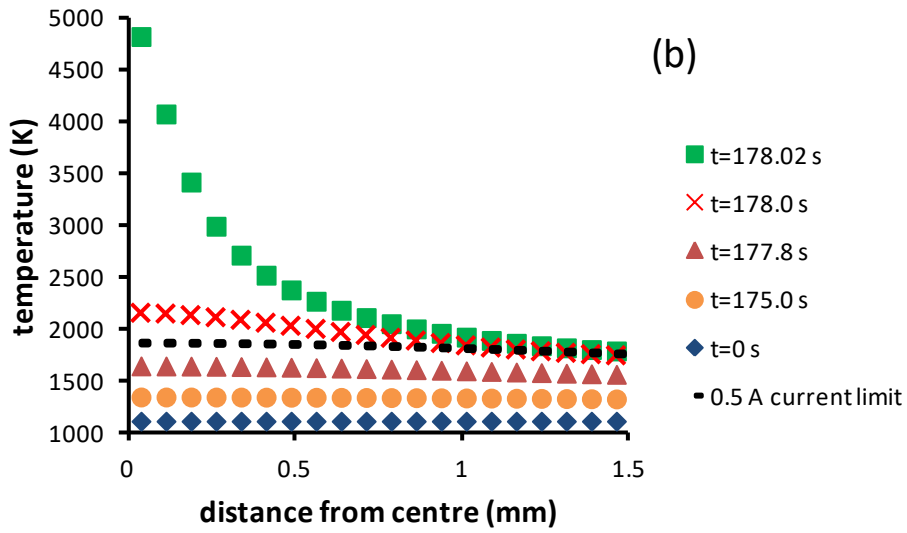
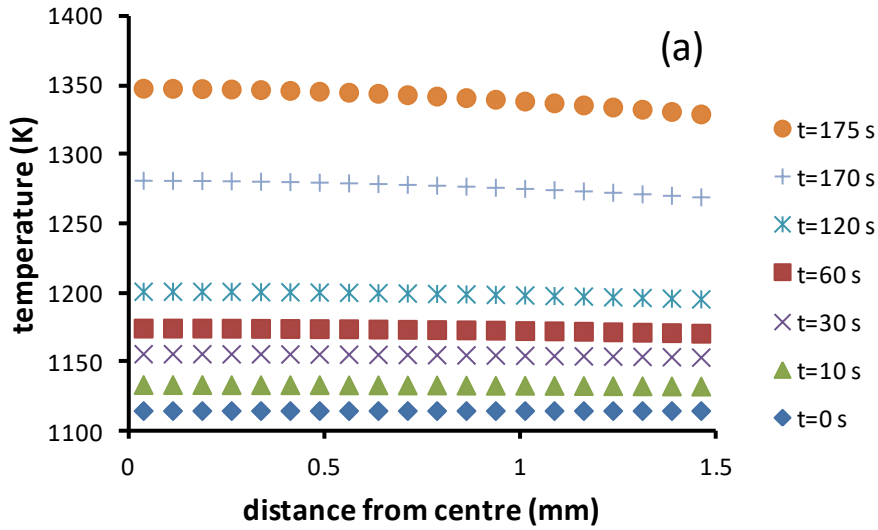


Figure 7. Predicted (DNU model) and experimental current as a function of time for an applied field of 300 V/cm.



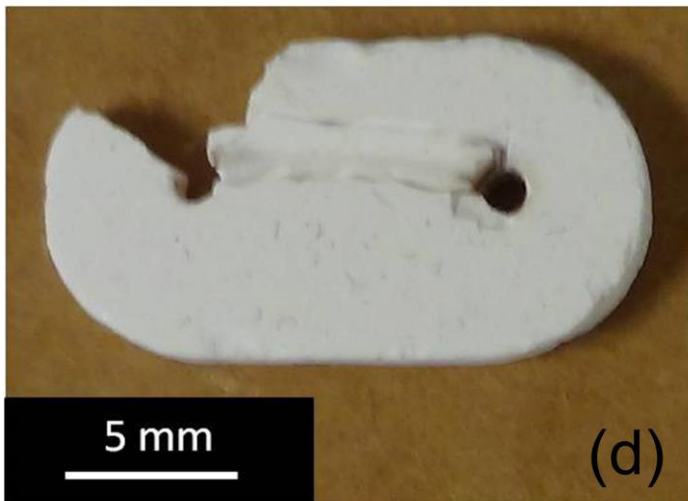
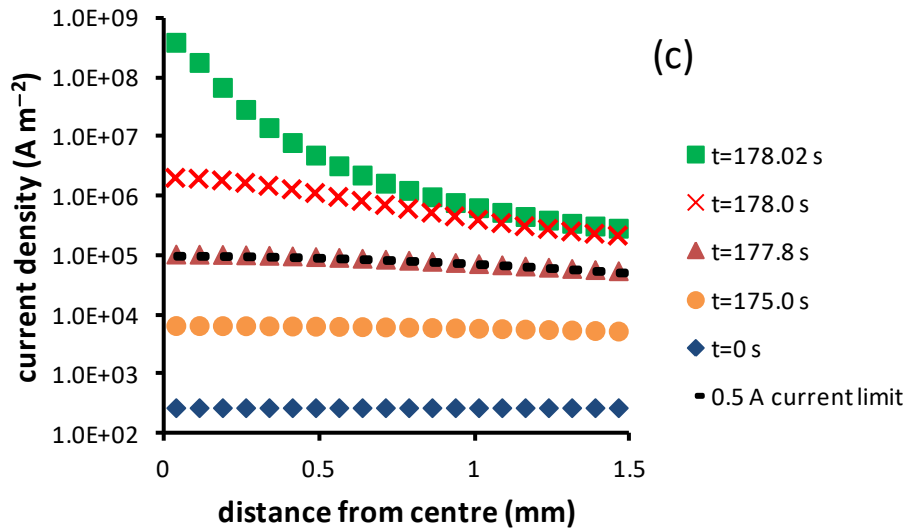


Figure 8. (a) Predicted specimen temperature profiles for different times after the application of a field $E = 300$ V/cm with a furnace temperature of 1115 K and unlimited current. (b) As for (a) but with expanded temperature scale. (c) Semi-logarithmic plot of corresponding current density profile. (d) Experimental specimen run under similar conditions.

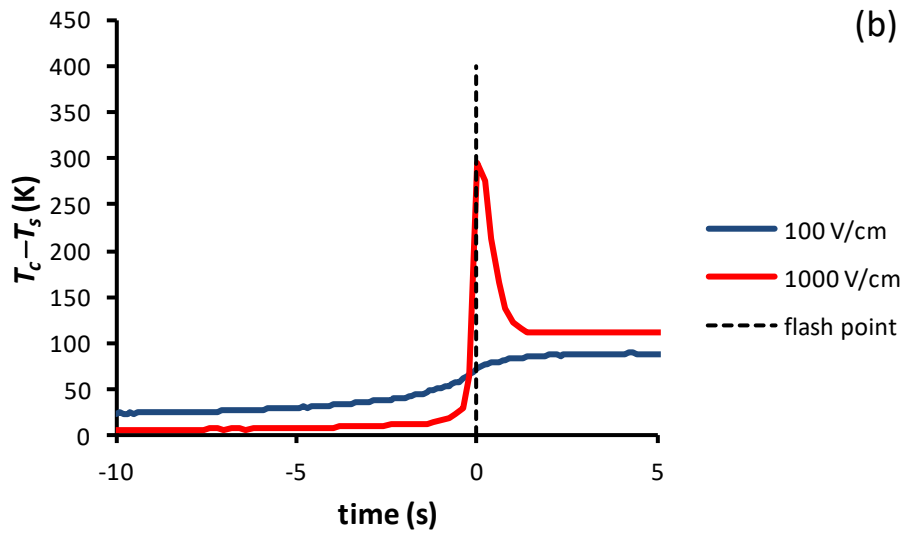
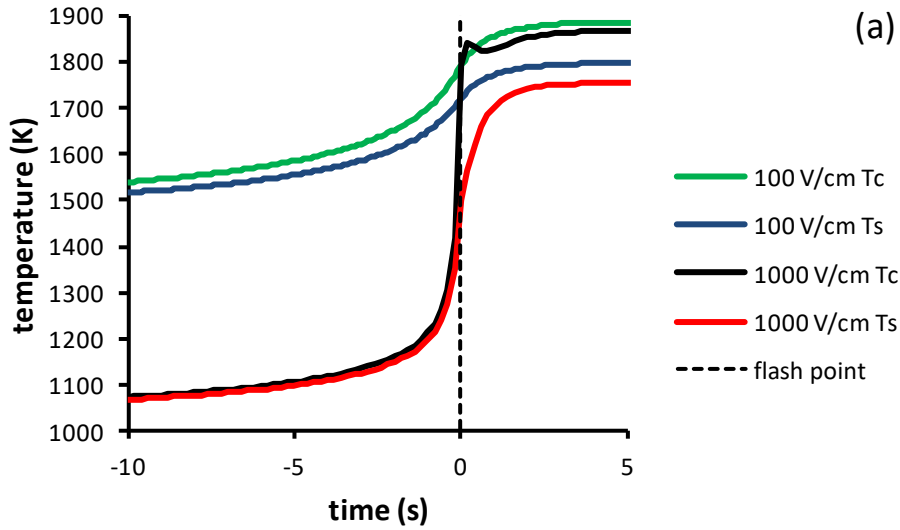


Figure 9. (a) Temperatures at specimen centre (T_c) and outer surface (T_s) and (b) Difference in temperature between centre and surface for applied fields of 100 and 1000 V/cm during the flash event. The time is defined to be zero when the limiting current of 0.5 A is reached.

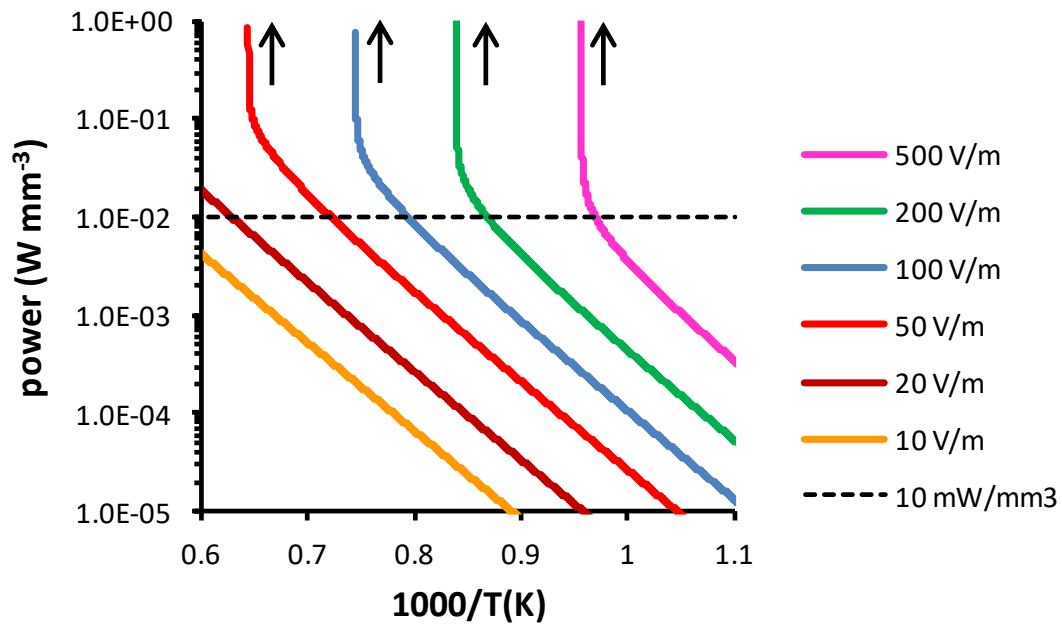


Figure 10. Predicted (DNU model) Arrhenius plot for specific power dissipation showing flash event at around 10 mW/mm³ for applied fields of 50 – 500 V/m. Lower voltages do not reach the flash point before conventional sintering temperatures are attained (1000/T ~ 0.6).

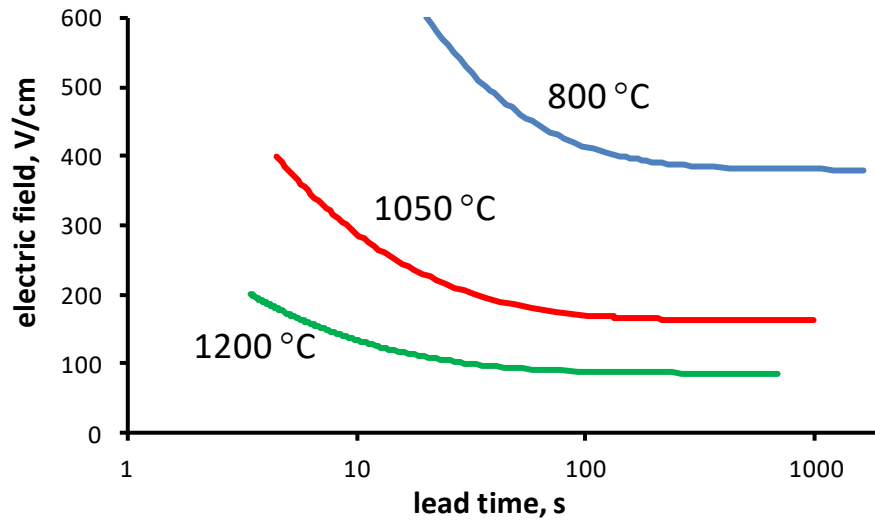


Figure 11. DNU model predictions of lead times at different electric fields and furnace temperatures for 3YSZ.