

THERMAL RUNAWAY, DYNAMIC STABILITY AND PROCESS CONTROL IN FLASH SINTERING

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Flash sintering is an innovative sintering method in which a critical combination of electrical field and temperature triggers a sudden densification in seconds. Due to the nature of the process, the flash sintering conditions lead to a non-linear conductivity surge followed by current control. This work tries to answer some questions related to process control during flash sintering by using a dynamic system model-based approach. An explicit solution for the folding points in the voltage control mode is presented (Figure 1). The analytical model uses a dynamic bifurcation approach which explains why the current control mode always leads to a steady state, due to the unicity of the solution to the equations, and why different modes of flash sintering such as current-controlled or power-controlled lead to a more uniform process. The model is validated with experiments in Cerium Oxide doped with Gadolinium and Yttrium.

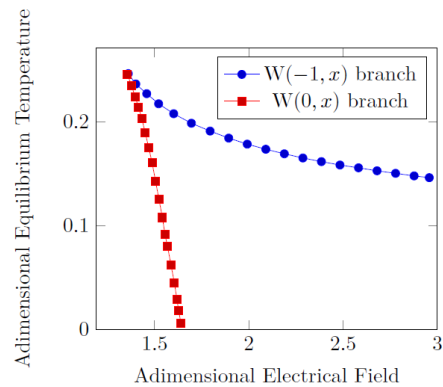


Figure 1. Branches of the folding point of the equilibrium surface.