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A FINITE-STRAIN COMPRESSIBLE THERMO-VISCOPLASTICITY MODEL FOR THE SIMULATION OF A FIELD ASSISTED SINTERING PROCESS

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The method of sintering powder materials by simultaneously using electrical current and pressure is known as field-assisted sintering technique (FAST) or electrically aided sintering. This process is characterized by an electrical current which flows directly through the graphite tool system and induces Joule heating. With this technology at hand fast heating and cooling lead to shorter production times and improved material properties.

In this process a powder is inserted into a die and compacted by a punch pressing on the powder material. At the same time the tool system is heated by an electrical current, which induces a volumetric distributed temperature. For the numerical simulation of this process the underlying thermo-electro-mechanically coupled problem has to be solved with large temperature changes and moving boundaries due to the compressible powder behavior. Beside the powder material the graphite die and the graphite punch have to be investigated to determine the electrical, thermal and mechanical behavior in the tool system, see [3]. Thus, one has to measure the temperature-dependent material properties, both of the graphite and the powder material, such as the thermal and electrical conductivity as well as the heat capacity.

Furthermore, FAST-experiments for the development of a phenomenological constitutive model are shown. Therefore, the model proposed in [1, 2] is modified and extended to describe the main effects during the sintering process. The final stress algorithm is implemented into a finite element program and a fully coupled monolithic simulation is performed in order to show the principal effects in a FAST-process and to predict the final shape of the sintered material.

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