Flash Spark Plasma Sintering for ultra-rapid consolidation of advanced ceramics

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During the past six years we developed a novel sintering technique called Flash Spark Plasma Sintering (FSPS) which is particularly suitable for the ultra-rapid (a few seconds) consolidation of a wide range of ceramics. This technique belongs to a wider family of Electric Current Assisted Sintering (ECAS[1]) techniques. As in the case of incandescent lamps, flash sintering[2] techniques use localized Joule heating developed within the consolidating particles using typically a die-less configuration. Heating rates are extreme (10^4–10^6 °C/min), and the sintering temperature is therefore reached immediately after applying suitable electric power. The research covered mostly metallic conductors (ZrB_2[3],HfB_2,TiB_2[4]), semiconductors (B_4C[5], SiC[6] and their composites) and some attempts on ionic conductors (ZrO_2 and glasses). The talk will summarize the international joint efforts to:
-Identify the FSPS consolidation mechanism using FEM modelling and transmission electron microscopy,
-Characterise the structural properties for the bulk materials and redefine the structure-property relationships of FSPSed materials
- Use FSPS processing to achieve unique materials by developing metastable phases and promote recrystallization to produce in situ nanostructured materials. FSPS also allows to control of defects.
- Control over interfaces for joining dissimilar materials[7].

The FAME (Field Assisted Material Engineering) research group established in China, Chengdu will be introduced.

References

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Keywords

ECAS, Flash Spark Plasma Sintering, Contactless Flash Sintering, Flash joining