

Flash Sintering of SiC Using Dr. Sinter SPS Machine

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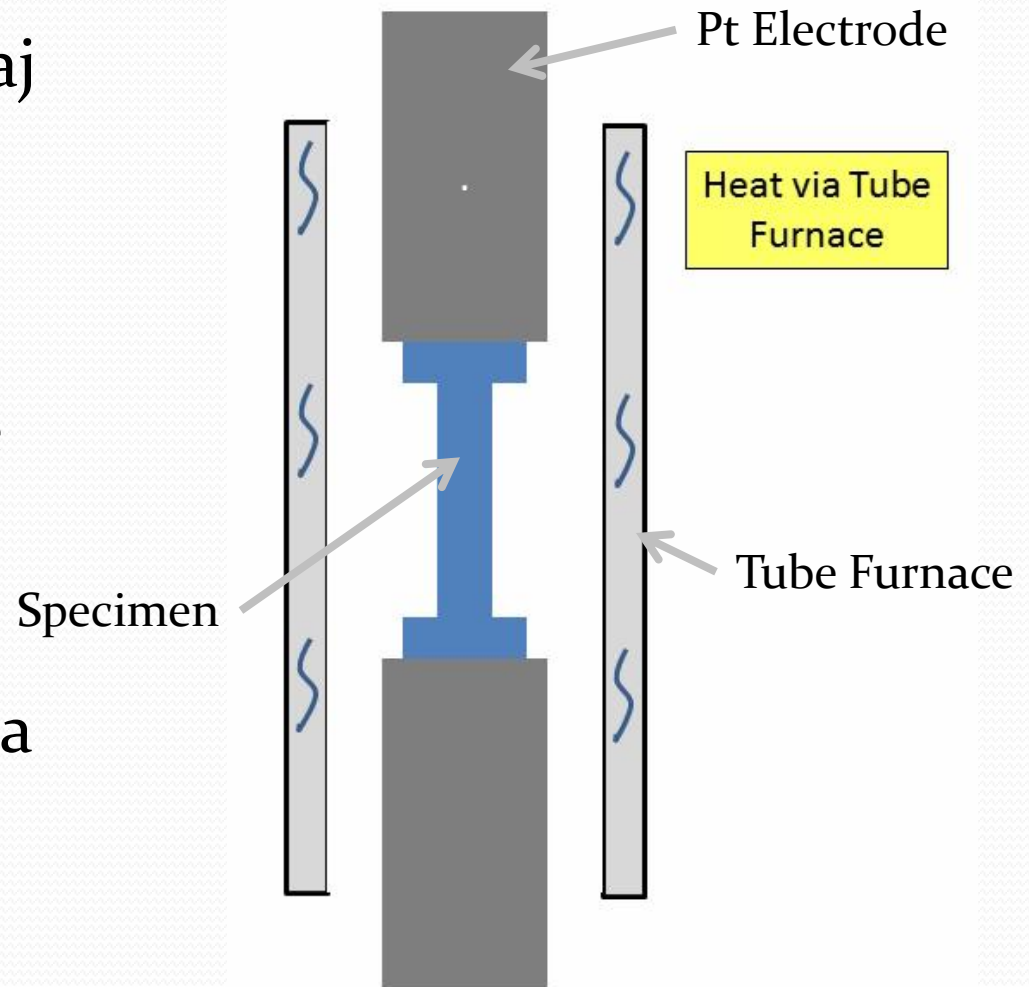
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Overview

- Flash Sintering Introduction
- SPS Equipment characteristics
- Flash Sintering Die Design
- Experimentation Procedures
- Sample Characterization
- Experiments
- Conclusions

Flash Sintering Experimentation

- Performed by Rishi Raj et.al.
- Yitria stabilized Zirconia powder
- Vertical Tube Furnace
- Dog bone specimen
- Pt Electrodes
- Shrinkage recorded via CCD camera



Principles of Flash Sintering

- Used with Semiconducting Material
- Heat until specimen becomes conductive
- Apply current through conductive specimen
- Specimen is heated by joule heating
- Rapid rise in temperature due to thermal runaway
- Rapid rise in Temperature leads to specimen consolidation

Advantages of Flash Sintering

- Rapid processing time
 - Each experiment takes ~10 minutes, compared to several hours associated with conventional sintering
 - Reduced energy costs
- Excellent Densification
- Reduced grain growth
 - Improved mechanical properties
 - Desification mechanism is too fast for grains to grow

Conclusions

- It is possible to conduct Flash sintering experiments with SPS equipment
- Excellent densification is possible with SiC specimens using Flash Sintering techniques
- Performance of Flash Sintering process seems to be related to Power Output of SPS machine at time of Flash, the more current flowing at the end of the process the higher the densification

Future Research

- Test Flash Sintering of SiC using dedicated equipment
- Test using higher applied electric potential, to see if current will flow through specimen after conductive path through the copper tube is broken
- Apply Flash sintering process to other materials