Additively Manufactured Conductive Polymer Spark Gap Igniters

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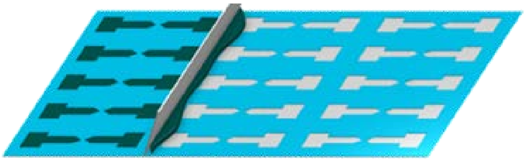
Project Description

- Conductive polymers present an opportunity to improve on current metallic igniter fabrication.
- Conductive polymers can be produced in solution and can thus be easily incorporated in scalable additive manufacturing processes.
- Conductive polymers also have the advantage of lower densities and lower susceptibility to corrosion as compared to metals.

Approach

- Polyaniline was doped with camphorsulfonic acid and mixed with m-cresol using a resonant mixer at an 8 wt% solids loading.
- Conductive ink was distributed into molds using a doctor blading technique.



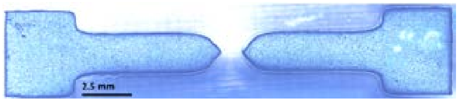
- Al-Bi_2O_3 nanothermite was inkjet printed on eight additional samples to demonstrate the igniters' ability to ignite energetic material.
- Spark gap igniters were tested using a high voltage power supply and oscilloscope.

Discussion

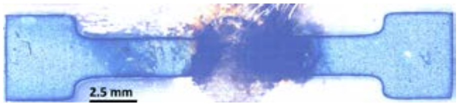
- Doctor blading was shown to be an effective technique for fabricating conductive polymer spark gap igniters.
- Spark gap samples showed no visible sign of degradation; further testing could prove their use in pulsed power applications.
- Future work will involve the integration of energetic material with the conductive ink to produce a single ink that is both conductive and energetic.

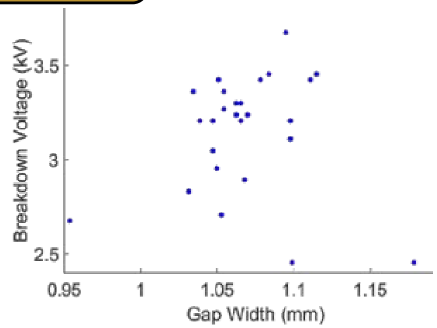
Results

Doctor blade manufactured conductive polymer spark gap igniter.



Doctor blade printed conductive polymer spark gap igniter with nanothermite before (above) and after (below) ignition.





All 27 samples successfully sparked over, and all eight additional samples ignited nanothermite.

Conductive polymer spark gap igniters present a lower density and more cost-effective alternative to traditional metal systems.