

# Precursor-Derived Nanostructured Si-C-X Materials for MHD Electrode Applications

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Yi-Hsun Yang, Zefeng Yu, Rajendra K. Borida (Co-PI) and Fumio S. Ohuchi (PI)

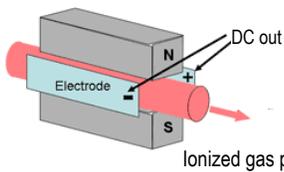


## Introduction and Project Goals

- Develop a novel class of SiC based ceramic composite materials with tailored compositions for channel electrode applications in MHD generators.
- Control and understand the effect of the nature of excess carbon in SiC on the structural and electrical properties.

## Background Information

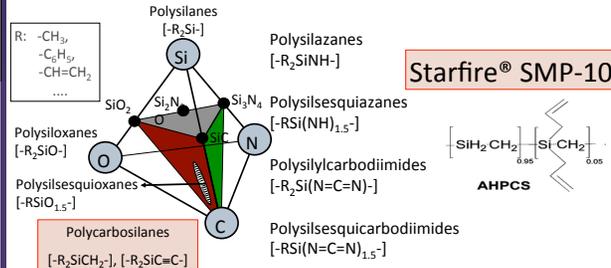
### MHD-Principle



Electrodes subjected to:

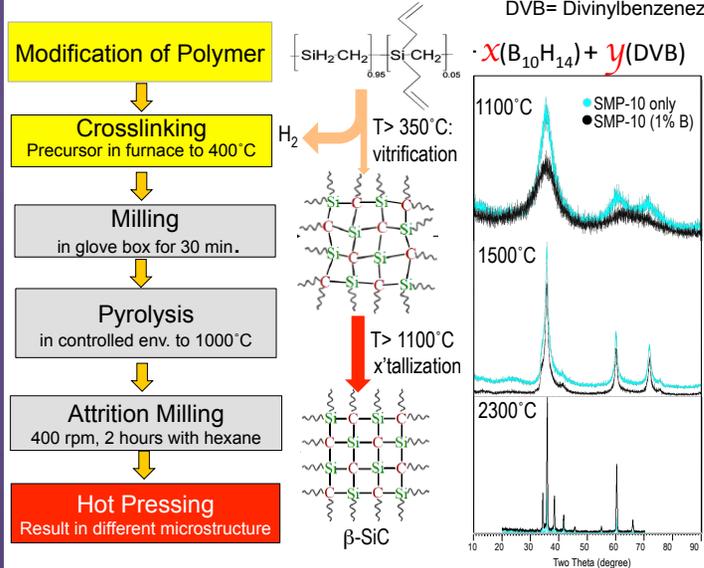
- extremely high temp.
- harsh environment
- electrical arcing

### Polymer-Derived Ceramics (PDCs)



- Availability of a wide variety of precursor polymers
- An attractive approach to make in-situ composites
- SiC: high temp semiconducting material
- Excess C in SiC (C:SiC) creates conductive path?

## Material Processing and X'tallization

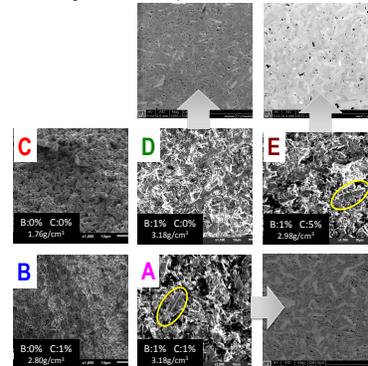


## Structure and Morphology : SEM

Composition	EDX
B <sub>10</sub> H <sub>14</sub> DVB	C : Si : O
A 1% 1%	68 : 27 : 5
B 0% 1%	66 : 24 : 10
C 0% 0%	63 : 35 : 2
D 1% 0%	65 : 32 : 3
E 1% 5%	71 : 26 : 3

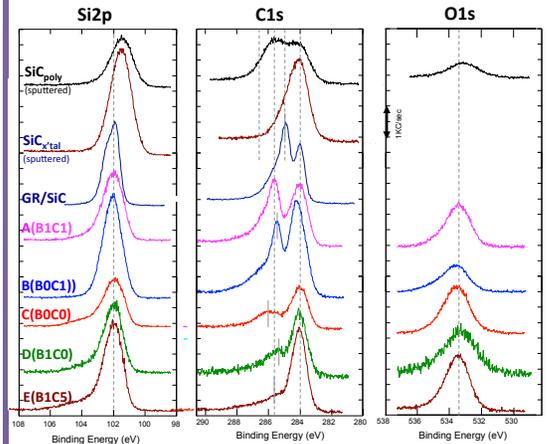


Inter-granular and polished surface



## Chemical Bonding : XPS

- XPS analysis of "Inter-granular fracture surfaces"
- Comparison with "Graphene grown on 6H-SiC (GR/SiC)"



- Excess carbon is present in intergranular boundary in the form of graphitic carbon.
- Boron additive is forming Boro-Silicate glassy film in the grain boundary serving as a sintering agent.
- Si 2p peaks (from commercial polycrystalline and single crystal) shift to lower binding energy due to sputtering.

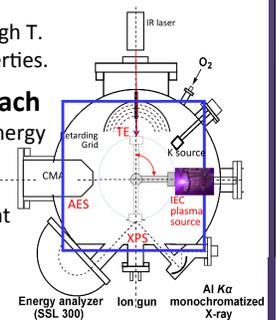
## What's next?

### Measure:

- Electrical conductivity at high T.
- Thermionic emission properties.

### Integrated Exp. Approach

- Total current and kinetic energy distribution of thermionic emission.
- Workfunction measurement
- Plasma exposure
- Seed deposition



### Acknowledgement :

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