Design, Synthesis, and Characterization of a New Piezo-/Ferroelectric Material for High Temperature Applications

PRESENTER:

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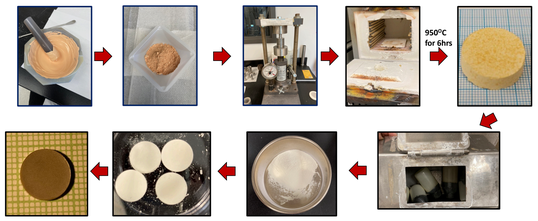
CHEMISTRY

BACKGROUND:

Piezoelectricity is the ability of a material to convert mechanical energy into electrical energy and vice versa. There is a growing need for piezoelectric materials that can be used in high temperature environments like car engines and nuclear reactors.

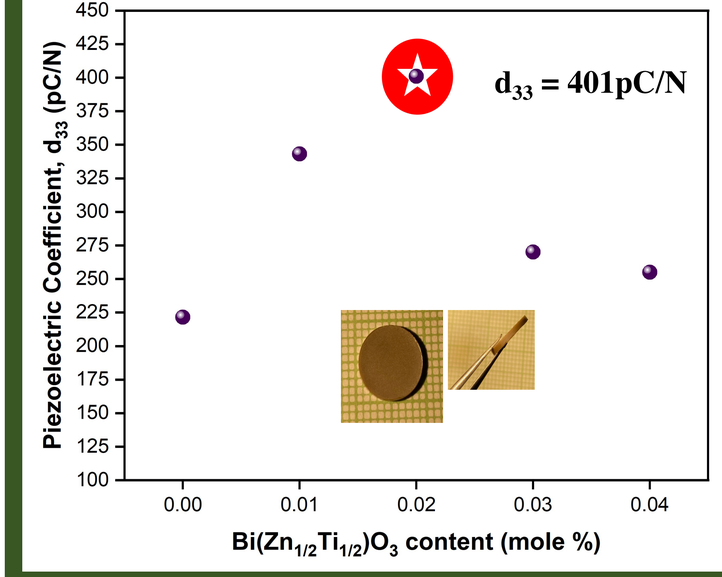
METHODS

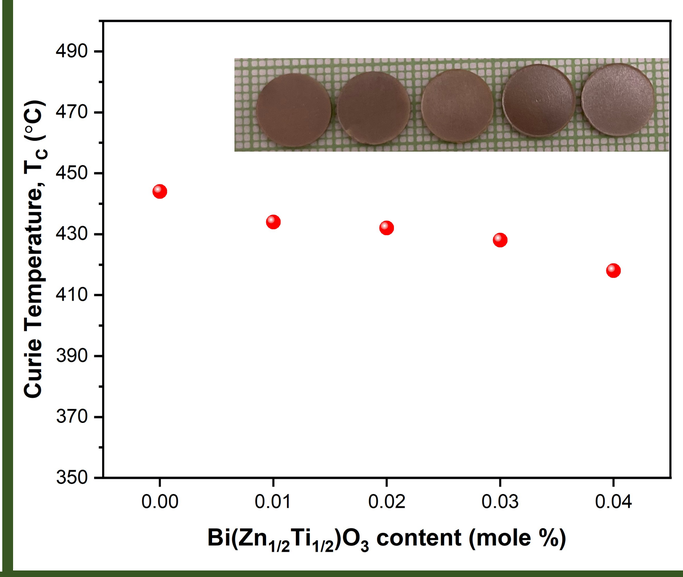
- Ceramics created by the solid-state synthesis method

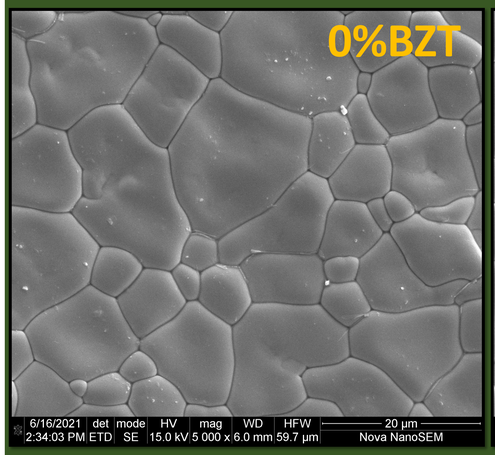


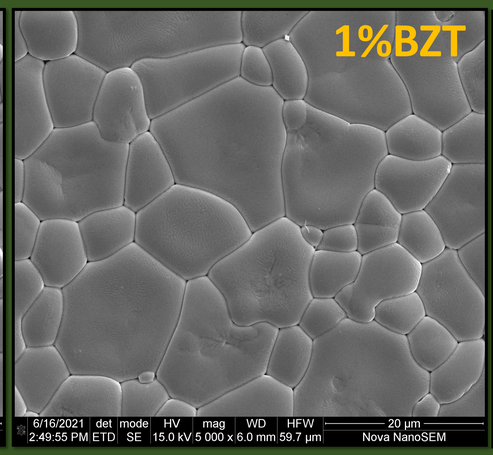
DISCUSSION

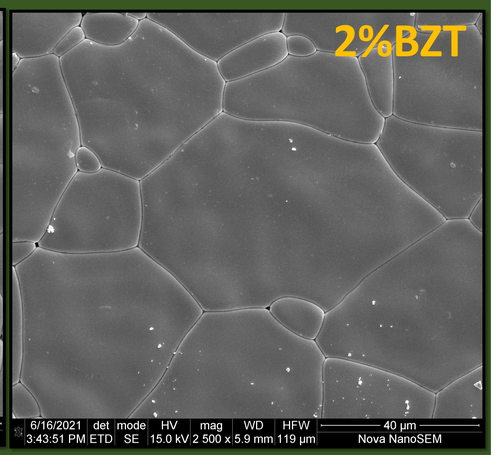
- The known $BiScO_3$-$PbTiO_3$ material was modified by integrating $Bi(Zn_{1/2}Ti_{1/2})O_3$ into its structure.
- Resulting ceramic had a maximum d_{33} = 401pC/N (piezoelectricity metric) at room temperature
- All ceramics have good ferroelectric properties at 200°C, a good indicator of high temperature piezoelectric properties, which are currently being investigated.

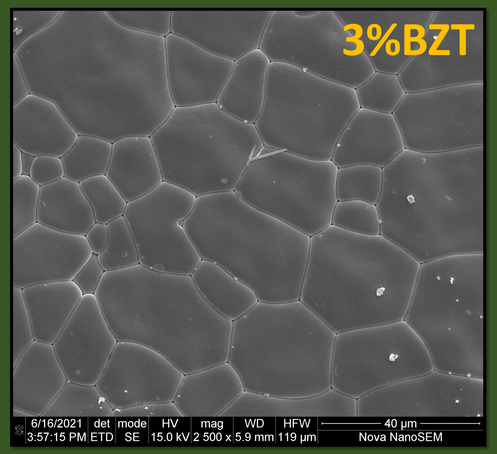


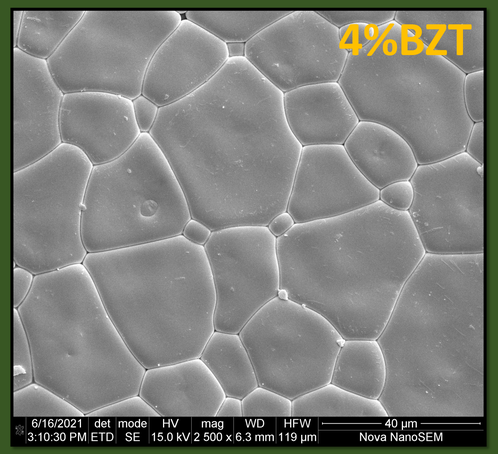




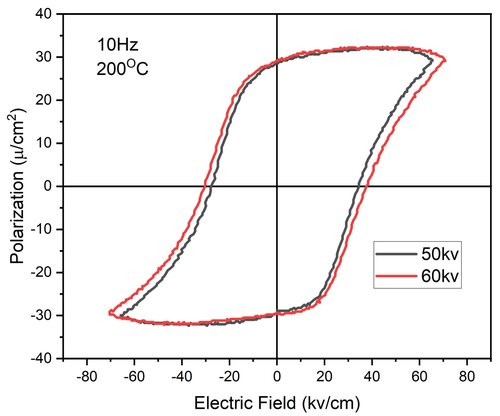




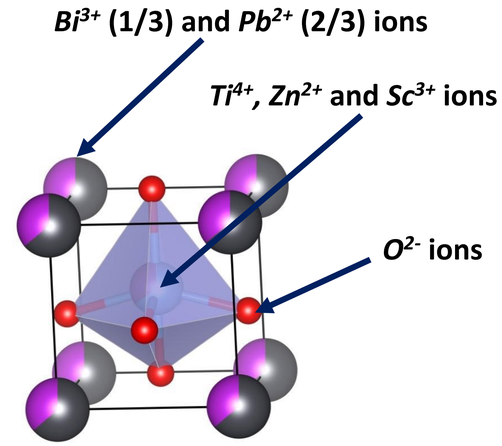




Ferroelectricity: Materials undergo spontaneous polarization when an electric field is applied. Ferroelectric materials are piezoelectric, so presence of ferroelectricity implies piezoelectricity. High temperature ferroelectricity of $BiScO_3$-$PbTiO_3$ with 4% $Bi(Zn_{1/2}Ti_{1/2})O_3$ is shown below.



Crystal structure of the $Bi(Zn_{1/2}Ti_{1/2})O_3$-$BiScO_3$-$PbTiO_3$



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undergraduate research symposium

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