**Workshop exercises for Writing to be Published, Found, and Read**

Exercise 1: *Identify the keywords in the following title and abstract*

**Electrocaloric Behavior and Temperature‐Dependent Scaling of Dynamic Hysteresis of Ba0.85Ca0.15Ti0.9Zr0.1O3 Ceramics**

This article presents electrocaloric effect in Ba0.85Ca0.15Ti0.9Zr0.1O3 (BCTZO) using an indirect approach based on Maxwell's relations. The peak electrocaloric performance is found to be an adiabatic temperature change of 0.41 K with electrocaloric strength of 19 mK cm/kV and a
heat carrying capacity of ~0.17 J/g under an electric field of 0–21.5 kV/cm. The ferroelectric hysteresis scaling relations for coercive field (Ec), remnant polarization (Pr), and hysteresis
area (<A>) as a function of temperature (T) are also systematically investigated. The power‐law temperature exponents are obtained for all the hysteresis parameters. The scaling relations are established as Ec ∝ T−0.6584, Pr ∝ T−1.59, and <A> ∝ T−1.01623. The presented scaling relations are compared with those reported in the literature for other ferroelectric materials.

Exercise 2: *Revise the title, putting important keywords first*

**Electrocaloric Behavior and Temperature‐Dependent Scaling of Dynamic Hysteresis of Ba0.85Ca0.15Ti0.9Zr0.1O3 Ceramics**

**Instructions for exercises 3 and 4**

You will see the title, abstract, keywords, and conclusions from two papers. These abstracts are acceptable for publication. But they can be improved. Your task is to revise two abstracts to be read by both your colleagues and by search engines.

The guidelines for a well-structured abstract.

1. Defining the problem or hypothesis
2. Important information about the research processes, summarized
3. Key findings and why they are important to ceramics/glass and society

Step-by-step

1. Keywords, keywords, keywords. Using the information in the title, abstract, and conclusions, determine what are the most important 3-5 keywords. The given keywords may or may not be the most important ones.
2. Reorganize the information that you have from the title, abstract, keywords, and conclusions into the categories above. You do not have to use all the information in the abstract and you can borrow some from the conclusions. It is possible that you will not have all the information you want. That’s okay. Do the best with what you have.
3. Connect these three concepts into a draft, writing to connect the three categories into a single paragraph. Make sure your sentences include the most important keywords 2-4 times each.
4. Once you have written your draft, reread it to make sure you have written an interesting and compelling story. There is no “right” answer here.
5. Previous students have found it useful to see how editors would revise the abstracts. These are available in the “Editor’s Answers” file. No cheating.

Exercise 3

## Microstructures and Properties of 3Y‐TZP/A0.5B0.5C12O19 Composites Prepared by Two Methods

Abstract

Two composites of A0.5B0.5C12O19 grains dispersed in a 3 mol% yttria‐doped zirconia (3Y‐TZP) matrix are prepared by two methods. The mechanical and electromagnetic properties of the both composites are investigated. The maximum values of the bending strength and the fracture toughness are 786 MPa and 8.6 MPa m1/2, respectively. The maximum value of the magnetization is 17.2 emu/g. In addition, the distribution of the A0.5B0.5C12O19 phase is described using the box dimension of the fractal theory. The impedance spectra of the both composites are fitted using the equivalent circuit model with a constant phase element (CPE). The obtained *p* value of the CPE can indirectly reflect the morphology of the A0.5B0.5C12O19 phase in both composites according to the universal relaxation law.

Keywords: ceramic matrix composites, electromagnetic properties, ferrites, mechanical properties

**Conclusion**

The composite SG2 has better mechanical and magnetic properties compared with the composite SG1. The bending strength and fracture toughness of the composite SG2 reach 786 MPa and 8.6 MPa m1/2. Its saturation magnetization is 17.2 emu/g. The composite SG2possesses the better comprehensive properties due to the microstructure with the fine and homogeneously dispersed A0.5B0.5C12O19 grains. The box dimension of the Ba0.5Sr0.5Fe12O19 phase boundary in composite SG1 is smaller than that in composite SG2. This reveals the existence of the large and agglomerated A0.5B0.5C12O19 grains with straight boundary in composite SG1. The *M*r/*M*s value of the composite SG2 is closer to 0.5 than that of the composite SG1, indicating the composite SG2 possesses more single‐domain structures and A0.5B0.5C12O19 grains are dispersed more homogeneously in SG2compared with the composite SG1. The *p* value for CPE2 in the composite SG2 is higher than that in the composite SG1. According to the universal relaxation law, this result reflects that the boundary between the A0.5B0.5C12O19 and 3Y‐TZP grains in the composite SG1 is weak due to the large A0.5B0.5C12O19 and fine 3Y‐TZP grains.

Exercise 3

Your working area (add pages as needed)

Exercise 4

**Novel processing approach to polymer‐derived ceramic matrix composites**

The rheological properties of commercially available polyX, *precursor*\*, were analyzed as a function of temperature, to guide development of thermal treatment processes for the improved yield and functionality of polymer ceramic precursors. The curing onset temperature for *precursor* was determined to be as low as 100°C for a heating rate of 1°C/min enabling a heat treatment process at 90°C, where low molecular weight oligomers volatilize from the liquid precursor prior to curing. By driving off the low molecular weight oligomers before fabrication of a composite, the mass yield of *precursor*, from a room temperature liquid state was increased from 77% to 83%. The development of B‐staging processes, or a semicure of *precursor*, were also demonstrated. B‐staging processes were then applied to polymer infiltration and pyrolysis processing and compared with traditional wet layup CMC processing. It was determined that B‐staging processes did not adversely affect ceramic matrix composite fabrication. B‐staged processing methods were determined to result in less waste, allow ply‐by‐ply control of matrix compositions, and enable time independent processing when compared to traditional wet layup processing methods.

\**Precursor* is the specific trade name for the product used in the study.

Keywords: ceramic matrix composites microstructure pre‐ceramic polymers silicon carbide

Conclusions

Rheological measurements were used to identify the onset of curing, at a heating rate of 1°C/min, where increases in the viscosity of *precursor* indicated that curing of *precursor* could be accomplished as low as 100°C. Based on rheological measurements, TGA experiments revealed that *precursor* could be heat‐treated for a time of 10 hours at 90°C, while preventing curing. Vacuum oven heat treatment process resulted in a mass yield of 83% and 81% for heat‐treated *precursor*, compared with 77% and 72% for two different lots of as‐received *precursor*. GPC revealed that low molecular weight oligomers can be volatilized at temperatures below the onset of curing, and that variations between the MW distribution of *precursor* will affect the heat treatment behavior. Understanding of the low temperature behavior of *precursor* guided the development of a B‐staging process, where the use of a B‐staged *precursor* allowed processing styles similar to polymer matrix composites, rather than conventional wet CMC layup processing. It was concluded that B‐staging did not adversely affect the PIP processing of CMCs. Advantages of B‐staged processing included less waste, where loss of slurry was observed from the wet processed laminate but not B‐staged laminate; ply‐by‐ply control of the matrix composition, where mixing of powders was observed at ply boundaries in the wet processed laminate but the designed matrix architecture was retained in the B‐staged laminate; and time independent processing, where segregation of HfB2 was observed in the wet processed laminate.

Working area for exercise 4