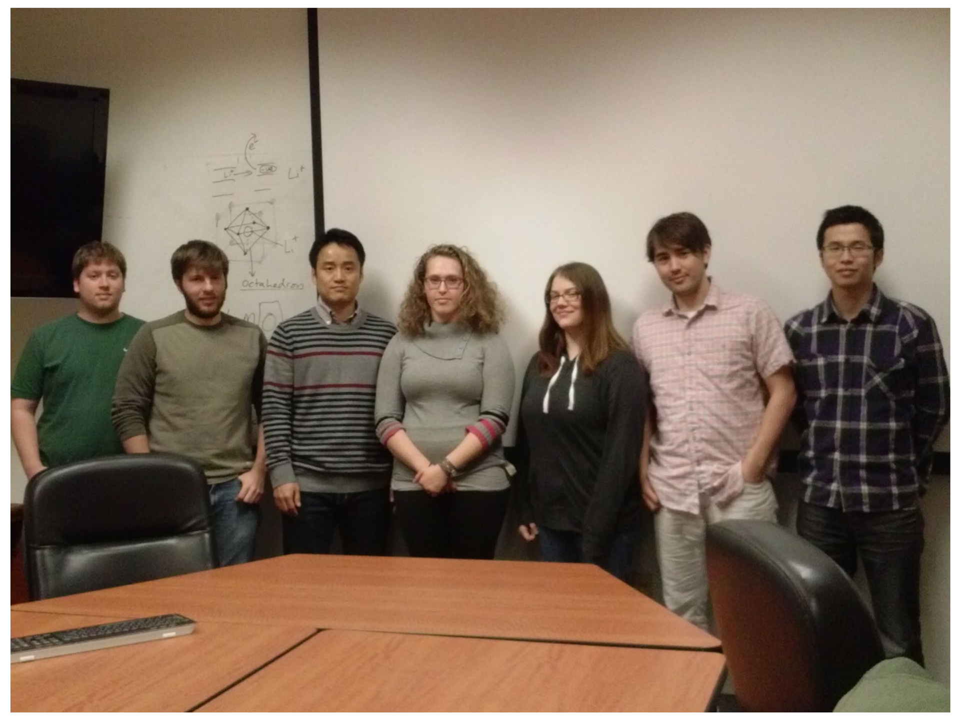
Professor Rosario A. Gerhardt's Research Group

School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta, GA, 30332

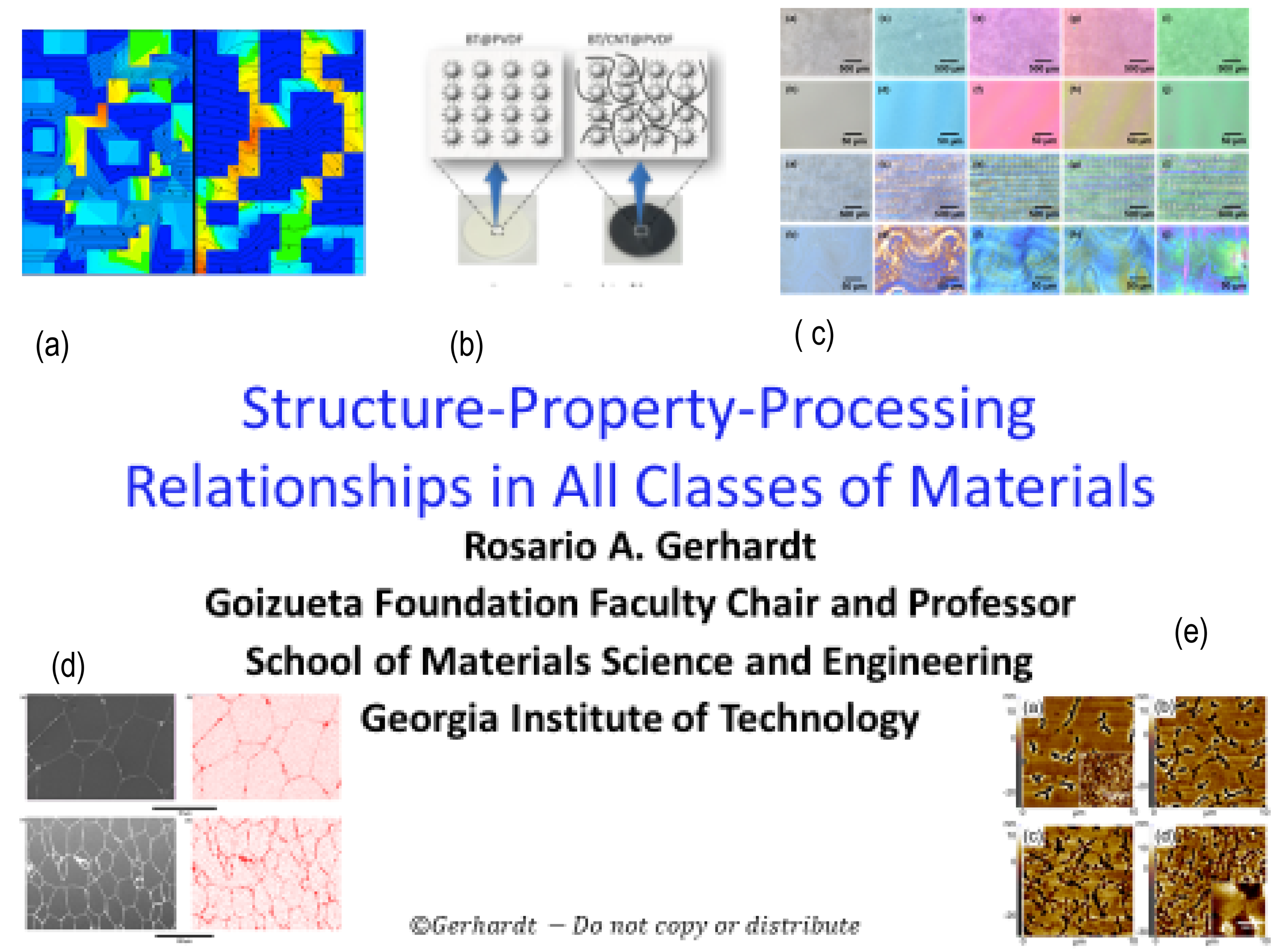
Introduction

In the lab of Prof. Rosario Gerhardt, research focuses on the relationships between microstructure and the physical properties of materials and their relationship to processing. There are currently 4 graduate students working on a diverse set of projects which cover the entire materials spectrum (metals, ceramics, polymers, semiconductors, nanomaterials and composites). These projects are for the most part, unified by the common themes of electrical properties and composite materials, Dr. Gerhardt's areas of expertise. Still, the diversity of research topics in the lab provides an environment which encourages graduate students to be well-rounded while still becoming experts in their own particular research area. Many of these projects stem from collaborations with national labs and industry. Graduate students also have access to a wide array of experimental equipment including an atomic force microscope, multiple ac electrical characterization equipment and fixtures as well as optical and thermal analysis equipment.



Recent Graduates: Thomas Rudzik, Tim Pruyn, Youngho Jin, Anna Janoff, Rachel Muhlbauer, Justin Brandt and Ning Xia

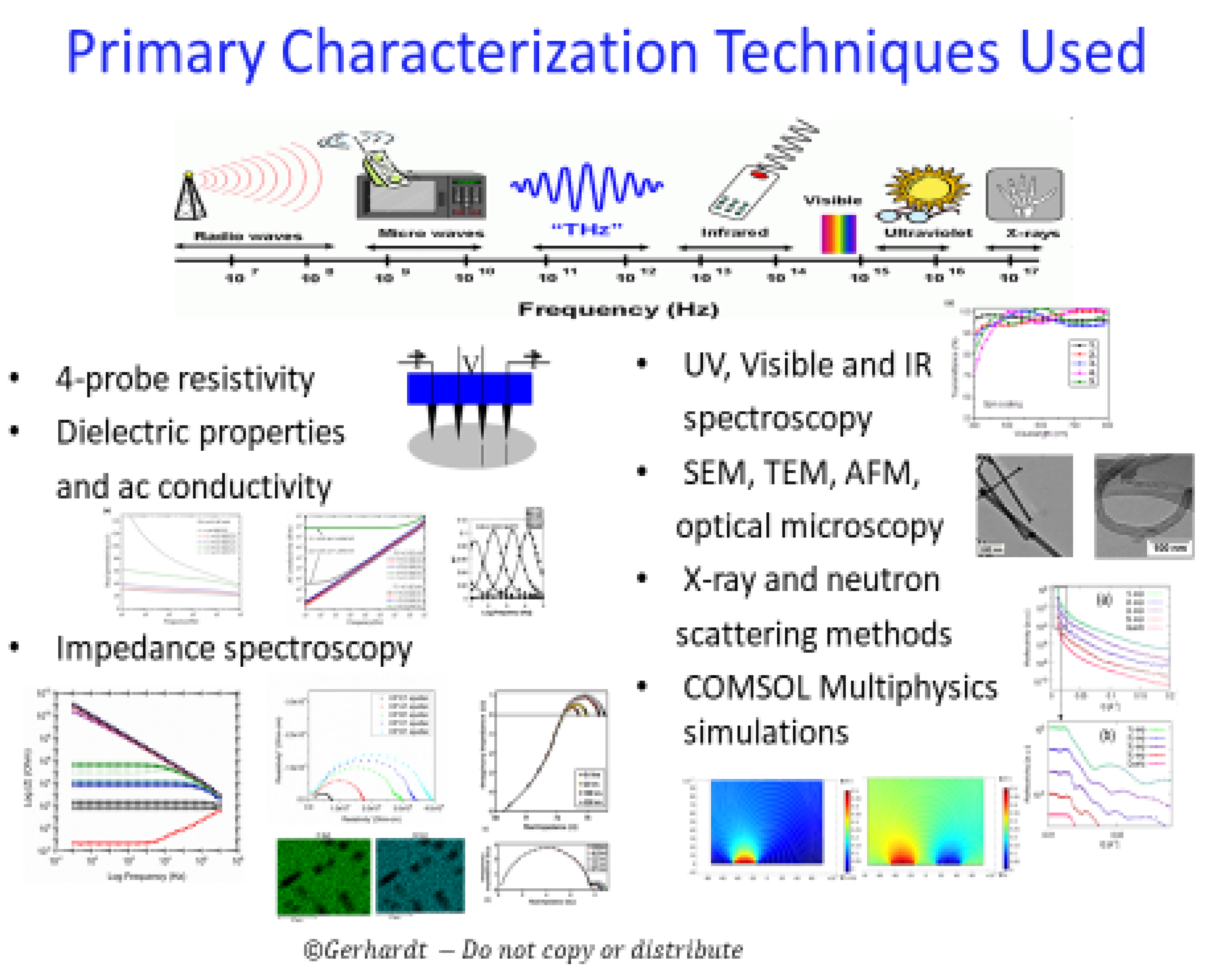
Overall Research Theme



(a) Current paths in a composite (b) effect of CNT addition to visual appearance (c) Optical images of spin coated and inkjet printerd ITO films, SEM and EDS images of a glass composite € AFM images of the surface of ITO films with nanovoids

Fall 2020 research group

Because of Covid-19 pandemic we had to conduct group meetings remotely via bluejeans



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ITO thin Film Results

A custom-made sol-gel ITO ink was used to to fabricate ITO films by spin coating under different humidity conditions.

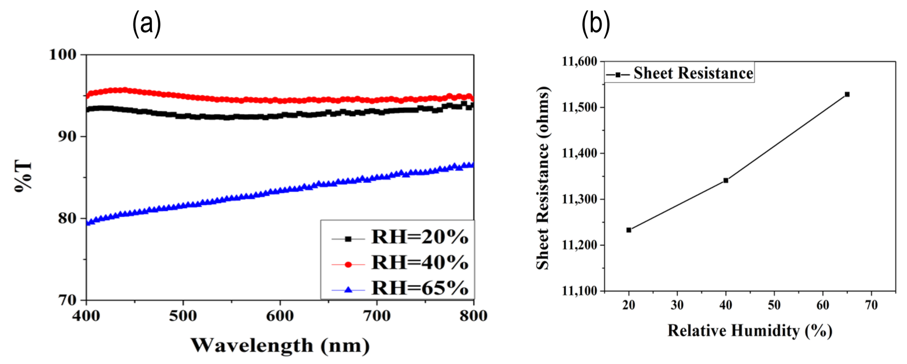


Figure 1. (a) Optical transmittance and (b) sheet resistance of ITO films as a function of the ambient humidity.

The sol-gel ITO ink was used to fabricate ITO films by ink-jet printing method. After annealing process, the ITO films show good combination of electrical properties, optical properties and surface morphology. These ITO films were used to demonstrate the formation of liquid crystal display (LCD) devices that shift in contrast when a DC voltage is applied.

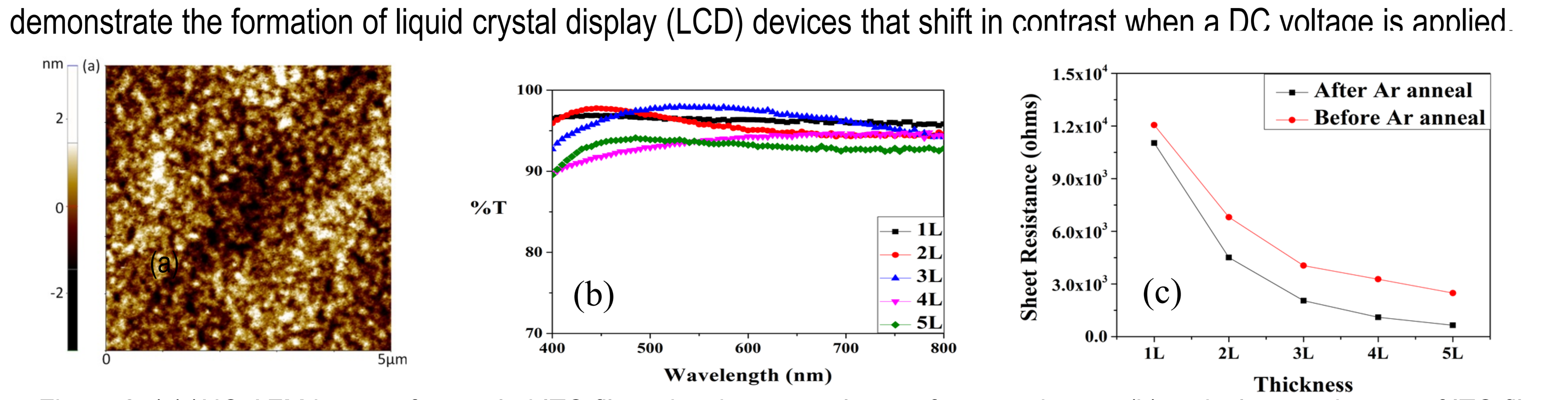


Figure 2. (a))NC-AFM image of annealed ITO films showing a very low surface roughness. (b) optical transmittance of ITO films after Ar annealing process (c) Sheet resistance of ink-jet printed ITO films as a function of number of layers deposited

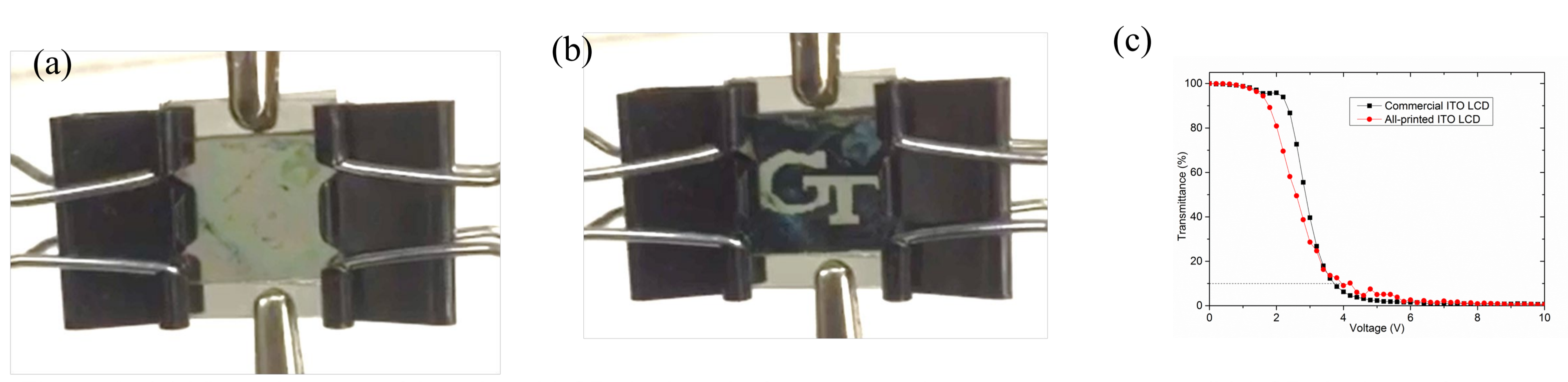
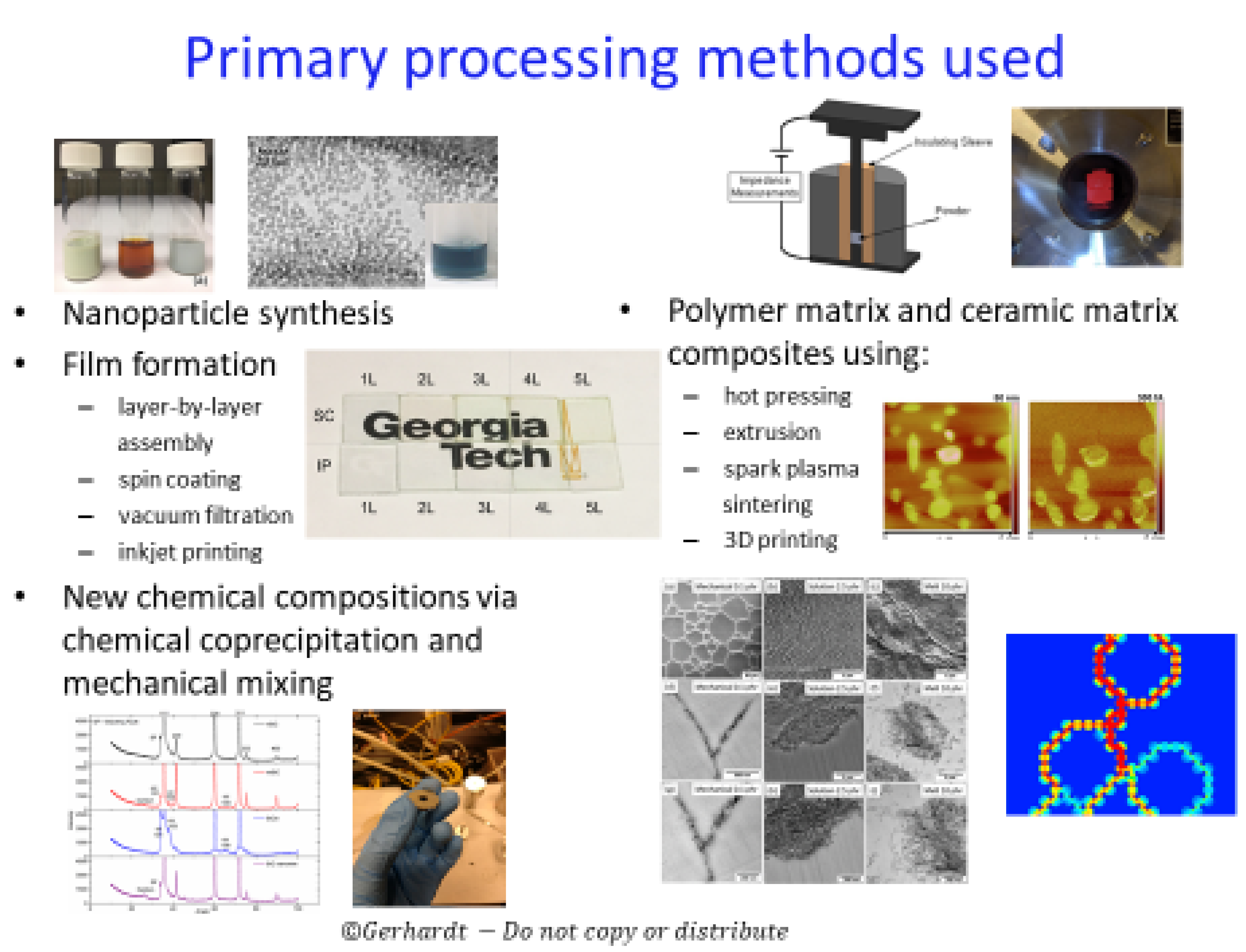


Figure 3. (a) Visual images of All-printed LCD devices before connecting to voltage source (b) LCD devices after connecting to voltage source. (c) V-T curves of commercial ITO LCD and ink-jet printed ITO LCD at 550nm wavelength



Collaborators: Valeria Lauter, Ken Littrell (Oak Ridge National Lab), Elliott Fowler, Mike Lilly, John Watt (Sandia National Labs), Jan Ilavsky (Argonne), C. Barry Carter (U. Conn.)