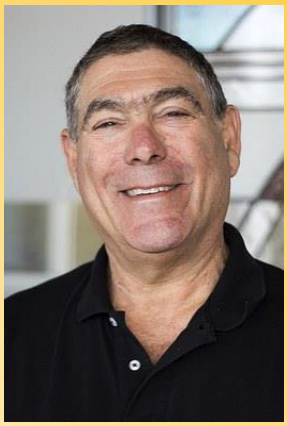
The 41st JUACEP Seminar

第 41 回 名古屋大学日米協働教育プログラムセミナー



Date: January 20 (Fri), 2017 15:30-

Venue: Lecture Room 232, Eng.Bldg-2

Lecturer: Prof. Richard M. Laine

Department of Materials Science and Engineering, University of Michigan

Mixed-metal oxide nanopowder used to process dense single and multi-layer flexible thin (10-40 μm) films including Li^+ superionic electrolytes

Current fabrication methods used to produce thin ceramic films include traditional tape casting, spin casting of precursor solutions or vapor deposition methods. For the most part, tape casting relies on doctor blading slips made from ceramic powders with particle sizes > 0.5 μm. Consequently, sintering to full densities generally leads to final grain sizes of 2-5 μm. This in turn limits final film thicknesses typically to 40-50 μm simply to avoid films just a few grains thick, to limit susceptibility to brittle failure during further processing.

In contrast spin-coating sol-gel and ceramic precursors can often provide uniform and sometimes epitaxial films (depending on substrate) but typically at thicknesses of just 1-5 μm and often only by repeated coating because of the very significant volume changes that occur as precursors transform to a dense ceramics.

Vapor deposition is often used to process very high quality thin films, especially in the electronics industry but is equipment intensive and again thicknesses beyond about 5 μm are sometimes quite tedious to process. Thus, there is considerable need for rapid, facile and low cost routes to 5-40 μm thick dense (or porous) ceramic films that offer superior mechanical properties but also versatility in the types of ceramic materials that can be made.

We present here, a simple method of making such films using wire-wound roller coating methods to cast thin polymer/ceramic nanopowder (NP) composites that can be made as single layers or laminated to make multiple ceramic laminates that on sintering provide dense single oxide thin films, ceramic composite thin films and ceramic/metal composite thin films. Several examples will be discussed including superionic lithium ion conducting electrolytes and cathode materials as well as some novel oxide materials.

略歴: 1969 年カリフォルニア州立大学化学部卒。1973 年南カリフォルニア大学博士号(化学)取得。デラウェア大、UC サンタバーバラ、スタンフォード国際研究所研究員を経て 1987 年ワシントンテクノロジーセンター研究員、1990 年からミシガン大学物質化学工学部教員。1999 年同大教授、Mayaterials 創設者兼 CEO、高分子化学工学センター統括者、EXIMO ハードコーティング社共同創設者。

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