



Preface

EMRS 2014 Solid State Ionics issue



We present the special issue of Solid State Ionics for the E-MRS Symposium on "Solid State Ionics – Thin Films for Energy and Information Applications". This symposium was held in the city of Lille in France, May 26th to 30th, 2014.

Through this symposium the rich and fascinating nature and possibilities to tune the defect chemistry and transport of solid state ionic and mixed electronic conducting material constituents in solid state batteries, fuel cells and resistive memories were investigated and discussed. Here, integration of thin films into small and light-weight energy conversion and harvesting devices or in memory logics is becoming increasingly important. Mass and charge transport in thin film materials, at their interfaces and electro-chemo-mechanics and structuring to new device concepts were in focus.

We enjoy highlighting that it is due to the broad potential of being able to alter and manipulate the interaction of non-stoichiometric and mechanical properties, chemistry, catalysis and transport in solid state thin films and at interfaces that a novel generation of ionically-controlled chip devices may define *Ionics as the new Electronics* of the future.

This symposium clearly highlighted that memories and logics based on ionically-controlled resistive switching in solid films may replace today's electronically controlled transistors; this offers new avenues to cope with Moore's law and to do the twist towards multi-resistance state memories and logics beyond the classic binary operation schemes. Here, designing suitable materials' defect chemistry and kinetics towards switching performance at high local electric field strengths, novel probing techniques for switches and identifying the role of interfaces are key to establishing fundamentals and optimizing device performance.

Ionic thin film structures and their trivial and non-trivial size effects on material properties define largely the efficiencies in energy storage and conversion of batteries, solid oxide fuel cells and electrolyzers. In particular, the role of electronic band structures vs. ionic defects defines the catalytic activities or ionic storage capacities of electrodes and interfaces. Strained or space charged interfaces require attention and are important tools besides classic doping alone to implicate on ionic and

electronic defect concentration profiles or their migration and association energies. Novel characterization methods for structure and chemical composition such as operando techniques connecting electric and electrochemical performances were largely explored and these define the making of novel solid state ionic material films for solid state energy storage and conversion devices.

The actuality of solid state ionic thin films, their characteristics and integration to novel electrochemical devices for information and energy conversion and storage was reflected in 145 contributions from 30 countries. We are inspired by the great contributions of our colleagues and appreciate the high quality of presentations and manuscripts. This E-MRS symposium revealed sparkling new ideas on the fundamentals and applied side of Solid State Ionics. Let's keep the ionic spark and venture out to novel exciting Solid State Ionic adventures with Warp 9 Speed Ahead on the Okuda Scale to an exciting future.

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