Assessing ion redistribution in thin film light-emitting electrochemical cells

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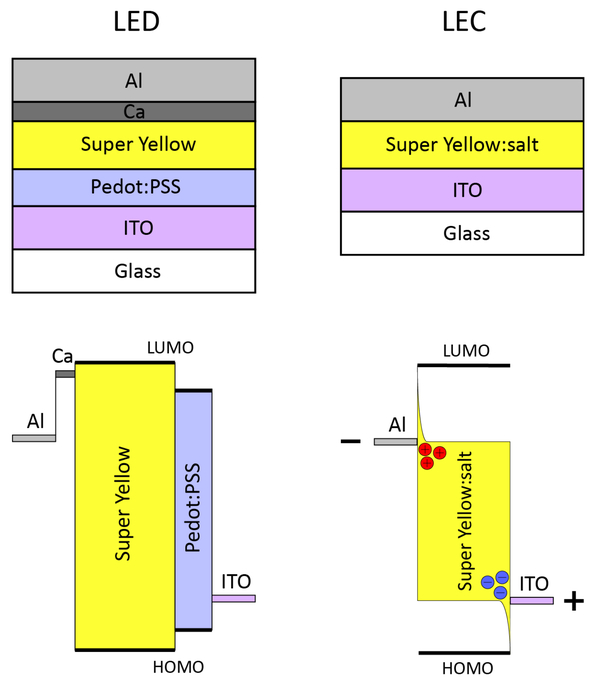


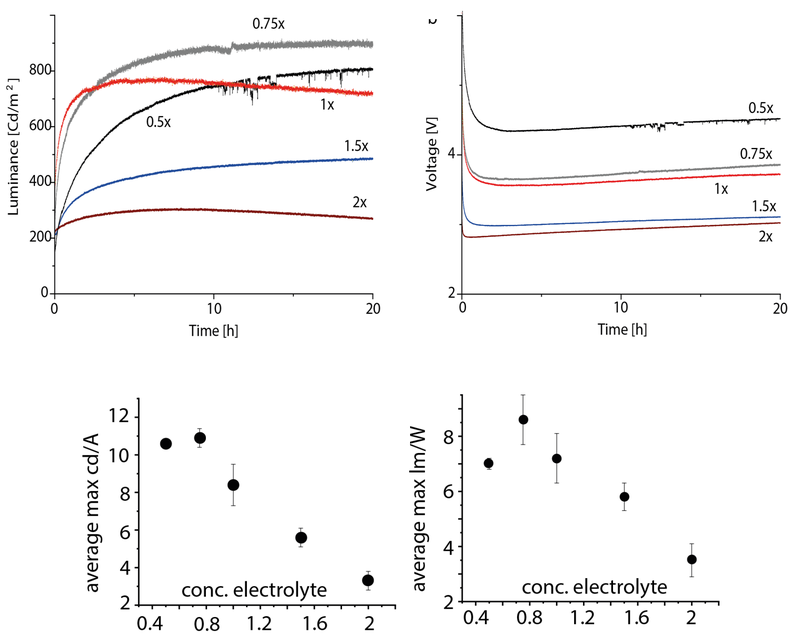
Introduction

- Simple one-layer structures are possible due to mobile ions added to the emitting layer
- For performance optimization, understanding of the complex device dynamics is crucial
- No comprehensive picture exists yet of the p-i-n dynamics, the ionic profile and the location of the emission zone

Results

Optimal performance

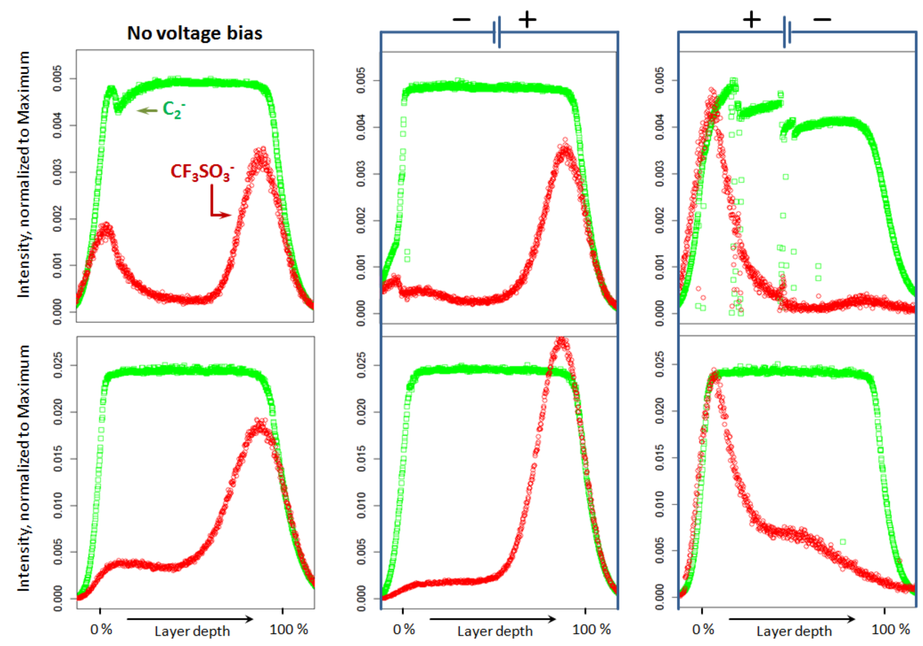
Fine-tuning of the electrolyte concentration boosts the reported device performance by over 30%



ToF-SIMS measurement of ion profile during operation

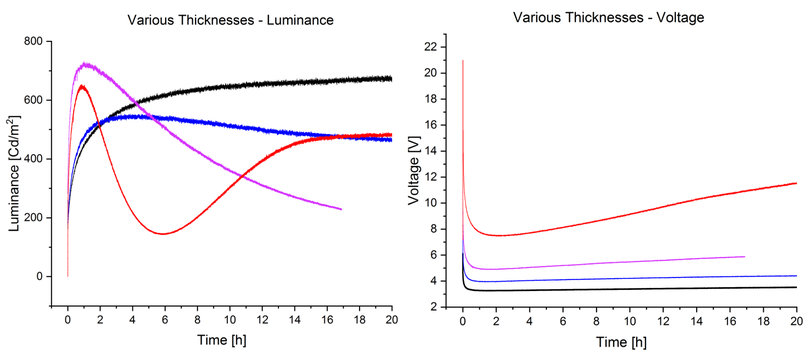
- In-situ depth profiling @ L-N2 temperatures
- Initial salt distribution is inhomogeneous and depends on salt concentration

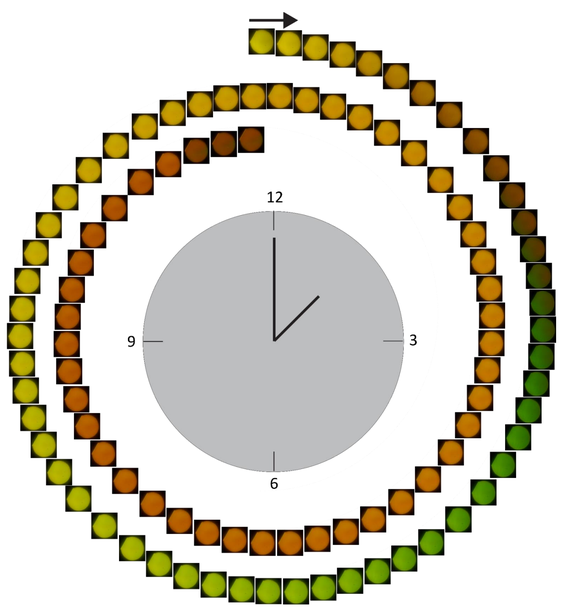
5 times more salt



M. Kawecki et al., ACS Appl. Mater. Interfaces, Review process

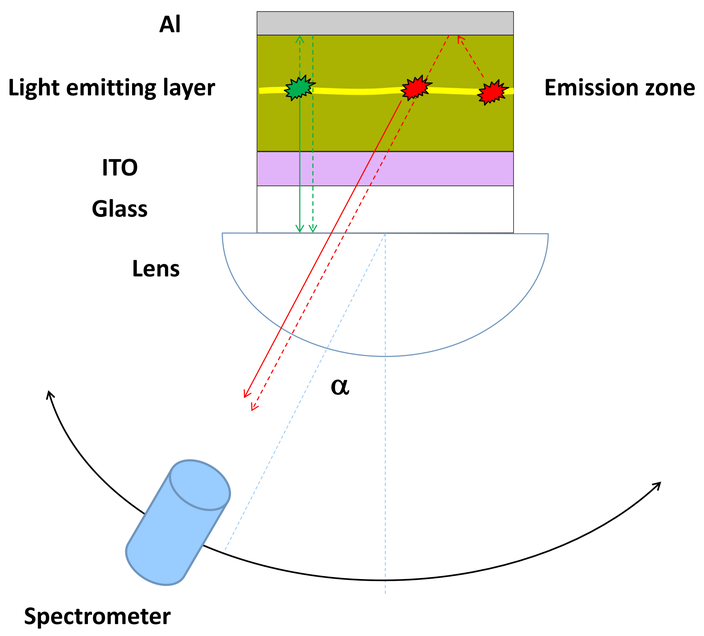
Thickness influence

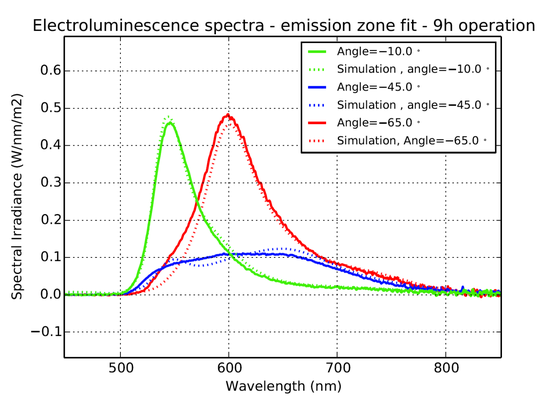


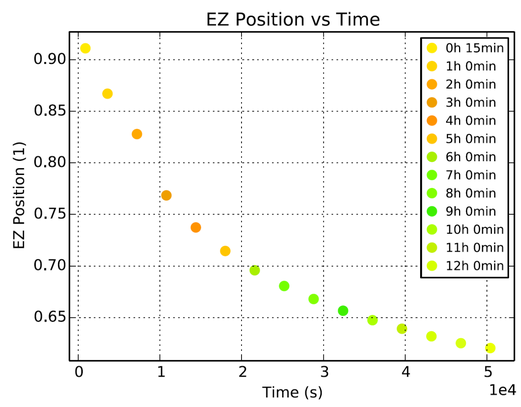


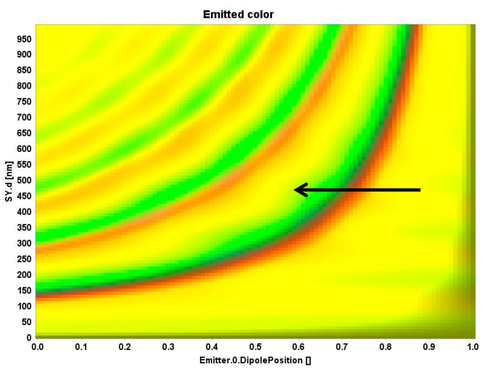
Angular emission measurement fitting

- Measurement of electroluminescence spectra at different angles
- Because of interference, the shape of the spectra depend on the position of the emission zone
- By fitting the measurement with an optical model, the position and shape of the emission zone can be determined









Conclusions

- The light emitting electrochemical cell is a highly dynamic system which depends on the salt concentration
- Initial salt distribution is inhomogeneous and depends on the salt concentration
- For thicker active layers, a color change over time is observed
- The dynamics of the emission zone can be determined by angular spectral measurement

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