

# Theme : OLED Materials

## Subject : 2-Dimensional Correlation Spectroscopy for OLED/Battery Degradation Analysis

### Introduction

To uncover the principles governing the relationship between material properties and device performances is important not only for designing new functional materials but also for improving the degradation of devices. However, despite such importance, it is still difficult to characterize how they are related with each other. Thus, the need for the development of a novel analytical technique which can provide more detailed information on the degradation phenomena is becoming more important.

In case of the analysis of OLEDs or Li-batteries, because they consist with a wide range of materials from organic compounds to inorganic composites, a variety of analytical method are required. However, the interpretation of the correlation among the analytical results obtained in different analytical method remains still uncertain.

Two dimensional correlation Spectroscopy (2D-COS) is a recently developed data analysis technique that is used to study the cross-correlation of the variations in analyzed results induced by an external perturbation, which is imposed on the system of interest. Accordingly, the goal of this research project is to explore the application of this new analysis technique to the degradation of devices, such as OLEDs and Li-batteries. We expect that 2D-COS contribute to research efficiency, such as lead-time shortening, because it can be applied to optimization of synthetic routes or manufacturing processes, as well as the analysis of degradation of materials.

### Scope

Challenges that significantly advance technologies for 2D-COS technique include, but not limited to:

- New mathematical approaches that are sensitive to the degradation of materials: Either experimental demonstration by instrumentation or rigorous theoretical background for new experimental approaches.
- New methodology that can be used to extract chemical and molecular information using conventional spectroscopy.

### Research questions

We are interested in the following research questions. These questions are not exhaustive but different research questions are open to discuss with research partners.

- How to apply 2D-COS to the degradation of electrochemical properties of thin-film layer-structured devices?
- Is it possible to apply 2D-COS to the surface analysis, such as XPS, Auger and ToF-SIMS, or the electron microscopic analysis?
- How 2-Dimensional Codistribution Spectroscopy (2D-CDS) contribute to the analysis of the dynamics of chemical reaction?

### Expected Deliverables

The following is open to discussion:

- Demonstration of new techniques.
- Collaboration through feasibility study of SAIT materials and devices
- Progress reports or papers summarizing accomplishments.
- Consultation on experimental and theoretical methods for publications.