New paradigms for high efficiency blue emitters for white OLEDs

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Rationale

Two key issues prevent current iridium-based, phosphorescent OLED emitters from gaining a major fraction of the world lighting markets:

- Iridium is the fourth rarest naturally-occurring element on the planet, so basing a large-scale, high-volume lighting industry on this resource is risky as well as detrimental to the environment.

- Iridium-based blue phosphor devices have short working lifetimes and low energy efficacy that are well-below industry expectations.

Recent research by Durham University on intramolecular charge transfer systems that enable TADF (ICT-TADF) and intermolecular exciplex charge transfer systems that enable TADF (Exciplex-TADF) has demonstrated very promising improvements in energy efficacy. Moreover, the novel molecular systems do not use iridium.
Overall Objective

Create innovative, high-efficiency, blue emitters for white OLEDs, which will create a major breakthrough in the cost performance and environmental-friendliness of OLED lighting.

- Develop thermally activated delayed fluorescence materials without iridium
- Design new high-efficiency blue emitters
- Produce novel white OLED lighting systems
Scientific and Technical Objectives

Objective 1
• Screen potential ICT-TADF and Exciplex-TADF compounds with theoretical models

Objective 2
• Synthesise the most promising ICT-TADF and Exciplex-TADF model compounds

Objective 3
• Characterise and select the best ICT-TADF and Exciplex-TADF synthesised compounds

Objective 4
• Design white stack units employing selected TADF based emitter and block materials

Objective 5
• Design close-to-production OLED lighting panel demonstrators
Work Plan

Material Modelling, Synthesis and Characterisation Phase

OLED Component Production Phase

OLED Lighting Device Production Phase

Modelling (TU Dresden)

Synthesis (KTU)

Characterisation (Durham University)

Emitter Layer Design and White Stack Integration (Novaled)

OLED Lighting Panel Demonstrators (Astron-FIAMM)

Dissemination and Exploitation (Intelligentsia)

Project Management (Intelligentsia)

Main task flows

WP Interdependencies
Expected Impacts

- Cost performance breakthroughs - lighting systems with production costs of 1\(\text{€}/100\) lm
- Secured and reinforced industrial technology leadership and substantially increased market presence in lighting
- Improved business opportunities and value creation in Europe in lighting by reinforced cooperation along the value chain
Consortium
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