All Bio-Phosphors for Highly Performing Low-Energy Bio-Hybrid Light-emitting Diodes

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Sara Ferrara[a], Rubén D. Costa[a]

[a] *Technical University of Munich, Chair of Biogenic Functional Materials, Schulgasse, 22, 94315 Straubing, Germany*

Bio-phosphors have emerged as an alternative to rare-earth color down-converting filters in light-emitting diodes (LEDs). They are mainly produced with biogenic emitters, like Fluorescent Proteins (FPs), embedded in polymer matrices.[1–3] The first bio-hybrid LED (Bio-HLED) with FP-phosphors featured a loss <10% of the emission intensity after 100 h.[1] This performance was recently enhanced using zero-thermal quenching PMMA-FP phosphors, reaching >150 days and 5 min of stability at low and high powers.[4] However, the ideal combination of highly efficient and stable fully biogenic phosphors is still in its infancy.[5] Here, we disclose the optimization of a bio-derived biodegradable polymer hosting and stabilizing a natural red FP – *mCherry*, as red-emitting phosphor in Bio-HLEDs. The photoluminescent properties of the bio-phosphors led to Bio-HLEDs with excellent photo-stabilities > 2000 h operating, representing 2 orders of magnitude enhancement compared to prior art. We are strongly convinced that our work represents a crucial breakthrough in the development of red emitting bio-phosphors and in the stabilization of further natural FPs.

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