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Bio-recognitive photonics of a DNA-guided organic semiconductor

Seung Hyuk Back[1,*], Jin Hyuk Park[2,*], Chunzhi Cui[2,*] & Dong June Ahn[1,2,3]

Incorporation of duplex DNA with higher molecular weights has attracted attention for a new opportunity towards a better organic light-emitting diode (OLED) capability. However, biological recognition by OLED materials is yet to be addressed. In this study, specific oligomeric DNA–DNA recognition is successfully achieved by tri (8-hydroxyquinoline) aluminium (Alq_3), an organic semiconductor. Alq_3 rods crystallized with guidance from single-strand DNA molecules show, strikingly, a unique distribution of the DNA molecules with a shape of an 'inverted' hourglass. The crystal's luminescent intensity is enhanced by 1.6-fold upon recognition of the perfect-matched target DNA sequence, but not in the case of a single-base mismatched one. The DNA–DNA recognition forming double-helix structure is identified to occur only in the rod's outer periphery. This study opens up new opportunities of Alq_3, one of the most widely used OLED materials, enabling biological recognition.

[1] KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul 02841, Korea. [2] Department of Chemical and Biological Engineering, Korea University, Seoul 02841, Korea. [3] Center for Theragnosis, Biomedical Research Institute, Korea Institute of Science and Technology, Seoul 02792, Korea. * These authors contributed equally to this work. Correspondence and requests for materials should be addressed to D.J.A. (email: ahn@korea.ac.kr).