Emission Properties of Liquid-Crystalline Trinuclear Gold(I) Complexes with Branched Side Chains

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Aggregation-induced emission (AIE) materials exhibit strong luminescence in the solid state. The AIE materials are of interest for potential applications in OLED and bio-imaging. Our research focuses on using Au(I) complexes with AIE properties. These complexes demonstrate aurophilic interaction, which leads to highly efficient luminescence. The luminescence behavior of these complexes depends on their aggregated structure, meaning that it can be adjusted by controlling the aggregation structure. We have reported that by using liquid crystallinity of the Au complexes their aggregated structure and luminescence properties can be controlled. Au complexes with liquid crystalline properties can be oriented with external stimuli like electric field and mechanical force. Thus, we can expect that this enables us to control the aggregated structure and luminescence behavior.

In this study, we synthesized trinuclear Au complexes with pyrazole ligands bearing branched side chains (Figure 1a). Here, we explore how the branched structure affects the thermodynamic and photophysical properties of these complexes. We found that the branched structure significantly lowers their melting point. For instance, the melting point of **E-H** without branched structure was 132 °C, while that of **E-Hex** with long branching chains was –15 °C. As a result, **E-Hex** exhibiting a discotic nematic phase (N_D) over an extensive temperature range from -15 °C to its thermal decomposition temperature (285 °C). All complexes synthesized emitted room-temperature phosphorescence with the emission maximum at ~740 nm. Effects of the branched structure and phase structure of complexes on the photophysical properties will be discussed.

1) Y. Kuroda, *et al., Commun Chem*. **2020**, 3, 139.

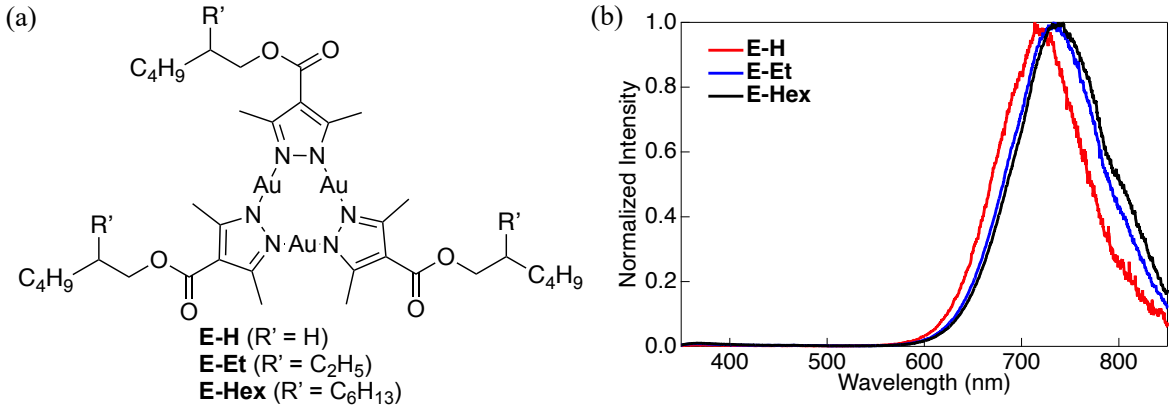

Figure 1. (a) Molecular structure of Au complexes used in this study. (b) Photoluminescence spectra of each Au complexes at room temperature (λ_{ex} = 300 nm).