Tuning the Au-Au Interactions in Luminescent Linear Polymeric Gold-NHC Complexes

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Luminescent organic molecules play a crucial role in the field of material science and life science. However, their application in industrial field has been limited because they suffer from the phenomenon known as 'Aggregation Caused Quenching' in condensed phases. Contrary to this, Tang *et.al.* reported the phenomenon called 'Aggregation Induced Emission' which opened the door towards the practical application of luminescent organic molecules in solid phases, for instance, in organic light emitting diodes (OLEDs), and has henceforth this phenomenon has played an important role in industrial applications. Among numerous other molecules, gold complexes have also been identified as promising AIEgens, due to their ability to show metalophilic d^{10}-d^{10} interactions in condensed phases, which deeply influences the luminescence behavior depending on the extent of these interactions. Changes in the molecular aggregates can be brought upon by application of external stimuli, therefore altering the aurophilic interactions, which is known as Aggregation Controlled Emission (ACE)[2]. For such fine tuning of the aggregated structures, a suitable choice of ligand is an important parameter, in which context N-heterocyclic carbenes (NHCs) have proven to be a good choice. In this context, polymers possess various desirable properties, like tunable structural morphology and mechanical strength.

Combining the properties of gold-NHC complexes with polymer science can lead to the development of materials that can show enhanced behavior and tunable properties with applications in plethora of fields. However, this field has attained less attention owing to the difficulties in the synthesis to control the degree of polymerization, purification methods and limited solubility of polymers. To overcome these challenges, in this work the authors report the synthesis of linear polymeric Au-NHC complexes, with benzimidazole moiety as the luminophore and alkyl/alkoxy spacers between the benzimidazole units. Their luminescence behavior depending on the degree of polymerization were reported along with comparative studies with the monomeric core structures.

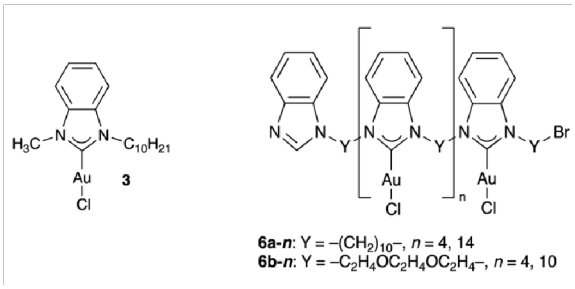

Figure 1. the polymeric complexes with alkyl spacer **6a-n** and alkoxy spacers **6b-n**.

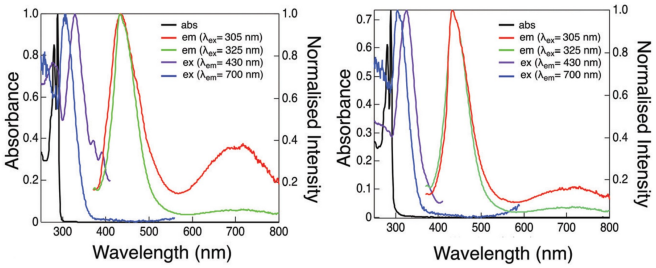

Figure 2. Absorption and photoluminescence spectra for the monomer **3** and the polymeric complexes **6a-4** and **6a-14**.

1) J. Luo, Z. Xie, J. W. Y. Lam, L. Cheng, H. Chen, C. Qiu, H. S. Kwok, X. Zhan, Y. Liu, D. Zhu and B. Z. Tang, *Chem. Commun*., **2001**, 1740.

2) K. Fujisawa, S. Yamada, Y. Yanagi, Y. Yoshioka, A. Kiyohara and O. Tsutsumi, *Sci. Rep*., **2015**, 5, 7934.