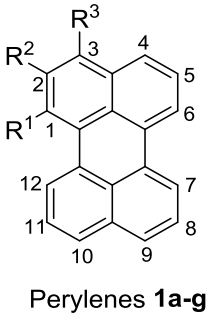
Exploring perylene based chromophores with enhanced solid state performance

Khushbu Kushwaha, Kati Stranius, and Karl Börjesson

Department of Chemistry and Molecular Biology, Kemigården 4, University of Gothenburg SE-412 96 Gothenburg, Sweden

E-mail: khushbu.kushwaha@gu.se, karl.borjesson@gu.se

In several emerging research fields, such as triplet-triplet annihilation and strong exciton-photon coupling,[1,2,3] the concentration of chromophores is of utmost importance. However, for the vast majority of chromophores, photo-physical properties such as emission quantum yields lowers significantly at high concentrations. Perylene is a well-established chromophore, highly absorbing and emitting in dilute solution. In this project, we aim at modifying perylene, to create alkyl substituted derivatives, with retained photo-physical properties at high concentration as compared to dilute solutions. We were able to synthesize 1-alkylperylenes in good to excellent yields by reacting perylene with alkyllithiums at low temperature (Fig.1). In case of sterically hindered alkyl lithium such as *t*-BuLi, reaction afforded 3-*tert*-butylperylene exclusively. Further, 2-*tert*-butylperylene was synthesized by Friedal Crafts alkylation of perylene in presence of aluminium chloride as lewis acid. Synthetic strategies, as well as photo-physical properties in solution and in the solid state is presented.



Perylenes **1a-g**

1a R^1 = H; R^2 = H; R^3 = H
1b R^1 = ethyl; R^2 = H; R^3 = H
1c R^1 = *n*-butyl; R^2 = H; R^3 = H
1d R^1 = *s*-butyl; R^2 = H; R^3 = H
1e R^1 = H; R^2 = H; R^3 = *s*-butyl
1f R^1 = H; R^2 = H; R^3 = *t*-butyl
1g R = H; R^2 = *t*-Butyl; R^3 = H

Figure 1. Synthesized alkylperylenes

Funding: Swedish Foundation of Strategic Research (ICA14-0018), and the Ragnar Söderberg Foundation

References:

[1] J. A. Hutchison, A. Liscio, T. Schwartz, A. Canaguier-Durand, C. Genet, V. Palermo, P. Samorì, T. W. Ebbesen, *Advanced Materials*, **2013**, 25, 2481

[2] D. G. Lidzey, D. D. C. Bradley, M. S. Skolnick, T. Virgili, S. Walker, D. M. Whittaker, *Nature*, **1998**, 395, 53

[3] W. Wang, P. Vasa, R. Pomraenke, R. Vogelgesang, A. -D Sio, E. Sommer, M. Maiuri, C. Manzoni, G. Cerullo, C. Lienau, *ACS Nano*, **2014**, 8, 1056