



# New Naphthalene Containing Conjugated Ladder Polymers via Microwave – Assisted Suzuki Coupling

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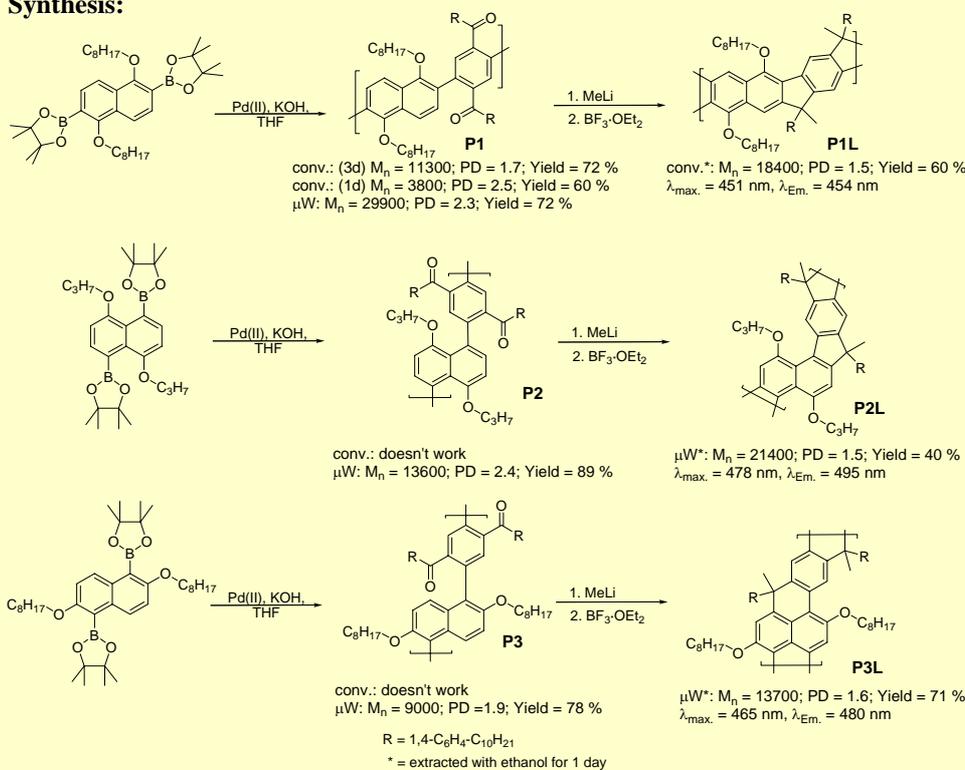
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## Introduction:

Aromatic ladder type polymers (LPPP) possess a unique set of optoelectronic properties due to their totally planar structure and consequently they have attracted a widespread attention as components for light emitting diodes (LED), lasing materials and two photon pumped fluorescence.<sup>[1]</sup> The chemistry of naphthalene derivatives is well developed however there are no examples to date of naphthalene containing ladder polymers which may exhibit interesting differences to the classic LPPP derivatives. One typical problem when preparing conjugated materials is the very long reaction times (3-5 days). There are many examples of microwave – accelerated metal catalyzed cross coupling preparations<sup>[2]</sup> of small molecules however they are very few in the synthesis of semiconducting polymers.<sup>[3,4]</sup>

## Synthesis:



## Method development & findings

- P1 is available by both aqueous  $\mu W$  and conventional procedure
- P2 and P3 are not achievable via  $\mu W$  or conventional heated aqueous protocols
- several bases, catalysts and non-aqueous solvent combinations were attempted, only the KOH/THF protocol was successful.
- the use of a microwave assisted protocol reduces dramatically the reaction time and allows also the synthesis of previously unavailable compounds
- the amount of base affects clearly the molecular weights (6 eq. per group were found as the optimum) (figure 2)
- no evidence of non-thermal effects

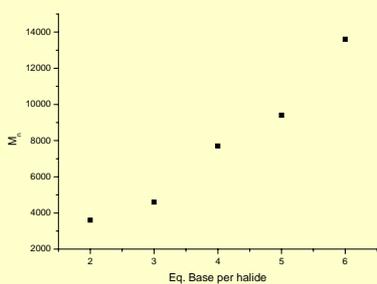


Figure 1: Effect of the amount of base on P2

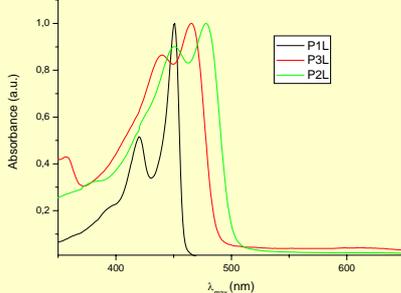


Figure 2: UV-spectra of P1L, P2L and P3L

## Results & Conclusion:

- a new nonaqueous microwave assisted Suzuki protocol has been developed
- the new polymers show a tunability of their optical properties
- allows access to a new series of ladder polymers based on naphthalene building blocks
- P3L is the first example of a ladder-polymer thoroughly composed of 6 membered rings

## References:

[1] U.Scherf, *J.Mater.Chem.*, **1999**, 9, 1843.; [2] P.Lidström, J.Tierney, B.Wathey, J.Westman, *Tetrahedron*, **2001**, 57, 9225; [3] K.R.Carter, *Macromolecules*, **2002**, 35, 6757; [4] B.S.Nehls, U.Asawapirom, S.Földner, E.Preis, T.Farrell, U.Scherf *Adv.Funct.Mater.*, in press

## Outlook:

The new non-aqueous synthetic protocol allows access to a wide range of polymers, which are not accessible via conventionally hated procedures. Therefore a widespread range of new derivatives like donor/acceptor polymers is imaginable. Next is to apply  $\mu W$  to other cross-coupling reactions such as Stille, Negishi, Heck and so on.