A Versatile Toolbox for Preparation of Functional Conductive Polymers

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Conductive polymers have been studied extensively during recent years. In order to broaden the application field of conductive polymers we have developed an azide functional poly(3,4-ethylenedioxythiophene) (PEDOT-N_3)(*1*). The azide functional conductive polymer can be postpolymerization functionalized to introduce a large number of functionalities through click chemistry(*2–4*).

Through selection of reaction conditions it is possible control the depth of the reaction into the polymer film to the upper surface or the entire film(5). Thus a conductive polymer can be prepared with a subsurface layer of highly conductive polymer where only the upper surface has been grafted with functional groups to ensure selectivity of the surface layer for e.g. interaction with specific biospecies. The conductive polymer can be patterned using selective etching, which enables preparation of e.g. interdigitated electrodes or other surface structures. The electrodes have been applied in controlled localized click reactions through ”electroclick” reactions(6). This enables preparation of both highly functional electrodes as well as gradient surfaces(7). The system is very versatile in all dimensions and structures and allows for preparation of conductive polymers with very specific properties.

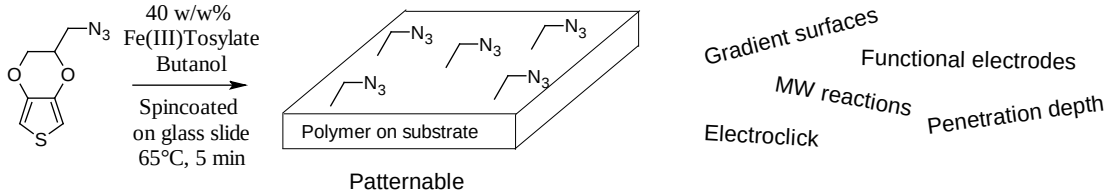

Figure 1: Preparation of functional conductive polymers and the versatility of the system.

References

(1) Daugaard, A.; Hansen, T.; Larsen, N.B.; Hvilsted, S. *Macromolecules* **2008**,*2*, 4321-4327.
(2) Binder, W. H.; Sachsenhofer, R. *Macrom. Rapid Comm.* **2008**, *29*, 952-981.
(3) Iha, R. K.; Wooley, K. L.; Nyström, A. M.; Burke, D. J.; Kade, M. J.; Hawker, C. J. *Chem. Rev.* **2009**, *109*, 5620-86.
(4) Meldal, M.; Tornøe, C. W. *Chemical reviews*. **2008**, *108*, 2952-3015.
(5) Lind, J. U.; Hansen, T. S.; Daugaard, A. E.; Hvilsted, S.; Andresen, T. L.; Larsen, N. B. *Macromolecules*. **2011**, *44*, 495-501.
(6) Hansen, T. S.; Daugaard, A. E.; Hvilsted, S.; Larsen, N. B. *Adv. Mater*. **2009**, *21*, 4483-4486.
(7) Hansen, T. S.; Lind, J. U.; Daugaard, A. E.; Hvilsted, S.; Andresen, T. L.; Larsen, N. B. *Langmuir* **2010**, *26*, 16171-7.