RESEARCH CENTER FOR MICRO- AND NANOCHEMISTRY AND -ENGINEERING
UNIVERSITÄT SIEGEN

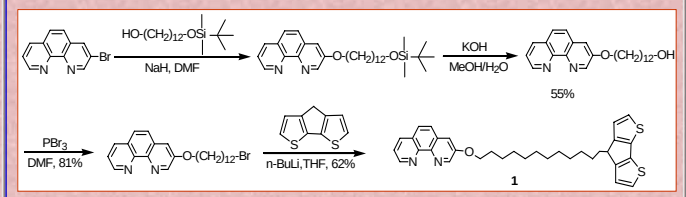
Universität Siegen, Organische Chemie I,
Adolf-Reichwein-Str. 2, D-57068 Siegen,
Tel: +49 271 740 4340
e-mail: lin@chemie.uni-siegen.de

Electropolymerization of a Phenanthroline Dithiophene Hybrid: A Versatile Template for Surface Functionalization

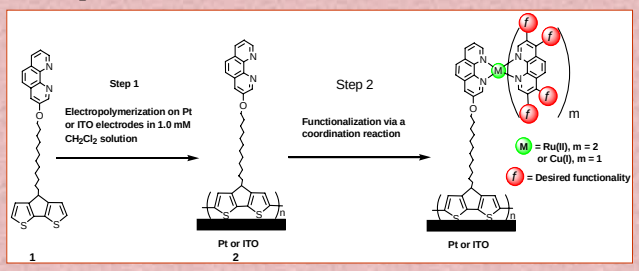
Hengwei Lin, Ravuri Kishore and Michael Schmittel

Introduction: Surface functionalization has, in recent years, grown into an ever expanding area of research.[1] This has fueled a constant need for universal, efficient, and robust strategies to fabricate various substances on the surface. Herein, we present a simple but effective strategy to achieve surface functionalization by metal complexation as a post-electropolymerization step. This method opens an exciting possibility of exploring a whole gamut of metal coordinated species on the surface and extends their solution state applications to the surface.[2]

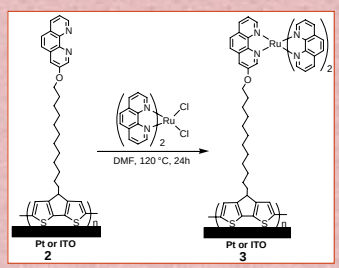
Monomer synthesis

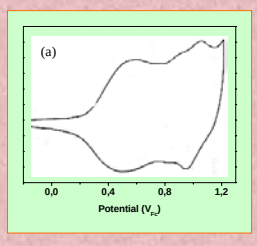


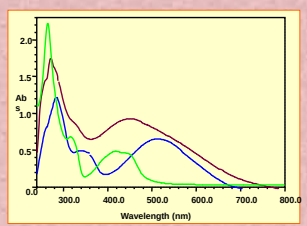
The steps of surface functionalization



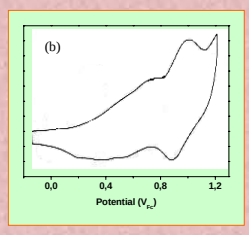
I Functionalization of 2 by ruthenium (II) phenanthroline complex





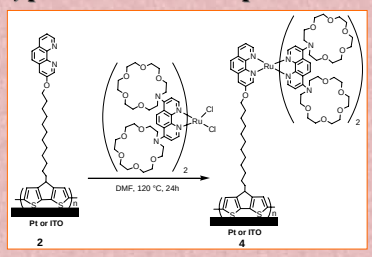


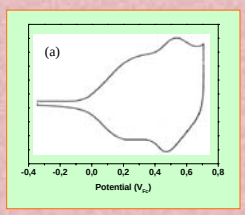
Comparison of UV-Vis spectra: Electropolymer 2 before complexation (blue line), Ru (II) complex 3 on ITO (brown line), and Ru (II) complex 3 monomer in dichloromethane (green line).

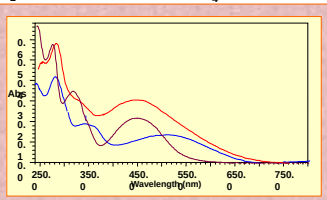


Cyclic voltammograms of electropolymer 2 on ITO before (a) and after (b) overoxidation of electropolymer 2 in monomer-free acetonitrile solution.

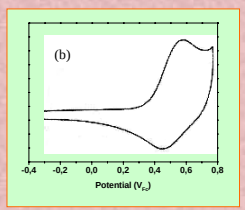
II Functionalization of 2 by crown ether-containing ruthenium (II) phenanthroline complex





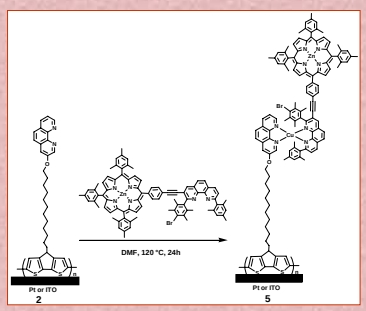


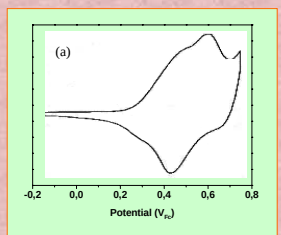
Comparison of UV-Vis spectra: Electropolymer 2 before complexation (blue line), Ru (II) complex 4 on ITO (red line), and Ru (II) complex 4 monomer in dichloromethane (brown line).

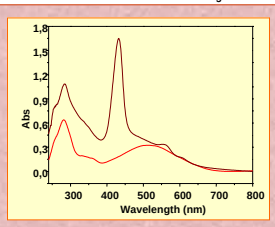


Cyclic voltammograms of electropolymer 4 on ITO before (a) and after (b) overoxidation of electropolymer 2 in monomer-free acetonitrile solution.

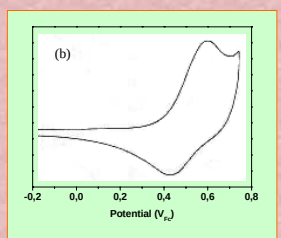
III Functionalization of 2 by a porphyrin appended phenanthroline copper (I) complex







Comparison of UV-Vis spectra: Electropolymer 2 before complexation (red line) and porphyrin appended Cu (I) complex 5 on ITO (brown line).



Cyclic voltammograms of electropolymer 5 on ITO before (a) and after (b) over-oxidation of electropolymer 2 in monomer-free acetonitrile solution.

Acknowledgments:
We are greatly indebted to Deutsche Forschungsgemeinschaft for financial support.

Conclusions:
A simple 2-step surface functionalization procedure has been developed. This method could be utilized effectively in modifying coordination complexes on surfaces and exploring their properites.

References:

1 (a) Deronzier, A.; Moutet, J.-C. *Coord. Chem. Rev.* 1996, *147*, 339-371. (b) Roncali, J. *J. Mater. Chem.* 1999, *9*, 1875.

2 (a) Ng, P. K.; Gong, X.; Chan, S. H.; Lam, L. S. M.; Chan, W. K. *Chem. Eur. J.* 2001, *7*, 4358-4367. (b)McQuade, D. T.; Pullen, A. E.; Swager, T. M. *Chem. Rev.* 2000, *100*, 2537-2574. (c) Schmittel, M.; Kishore, R. S. K. *Org. Lett.* 2004, *6*, 1923-1926. (d) Gust, D.; Moore, A. L. *Acc. Chem. Res.* 2001, *34*, 40-48.