doi:10.2533/chimia.2012.64

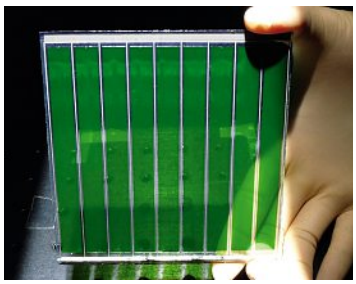
Swiss Science Concentrates

A CHIMIA Column

Short Abstracts of Interesting Recent Publications of Swiss Origin

Porphyrin-Sensitized Solar Cells with Cobalt(II/III)–Based Redox Electrolyte Exceed 12 Percent Efficiency

A. Yella, H.-W. Lee, H. N. Tsao, C. Yi, A. K. Chandiran, M. K. Nazeeruddin, E. W.-G. Diau, C.-Y. Yeh, S. M. Zakeeruddin, and M. Grätzel*, *Science,* **2011**, *334*, 629.
EPFL Lausanne, National Chung Hsing University (Taiwan), and National Chung Hsing University (Taiwan)
Dye-sensitized solar cells (DSCs) can be manufactured by simple screen printing methods, without the need for expensive purification and doping treatments. Thus, they offer an attractive alternative to solar cells based on semiconductors. However, their efficiency is only about half of that of Si-based solar cells. The authors now report a novel DSC that sets a new world record in conversion efficiency (12.3%). Additional attractive features include: no precious metals, slow back-electron transfer and high photovoltage (approaching 1 volt). The system consists of a donor-acceptor zinc porphyrin dye, which absorbs light over the entire visible spectrum, combined with a Co(II/III) tris(bipyridyl) redox electrolyte and nanocrystalline titanium dioxide. This report thus opens fascinating perspectives towards the widespread implementation of DSCs.

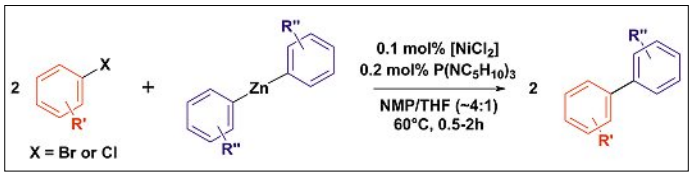


Electrically Driven Directional Motion of a Four-wheeled Molecule on a Metal Surface

T. Kudernac, N. Ruangsupapichat, M. Parschau, B. Maciá, N. Katsonis, S. R. Harutyunyan, K.-H. Ernst*, and B. L. Feringa*, *Nature* **2011**, *479*, 208.
University of Groningen, The Netherlands, Empa and University of Zurich
Propelling single molecules in a unidirectional manner on a surface is a challenging task. The authors report on the world's smallest vehicle which relies on electron flow from an STM tip to the metal surface to move forward. The nanocar is equipped with four independent rotary units acting as wheels. These consist of enantiopure, sterically congested tetrasubstituted alkenes which, upon electronic excitation, undergo *cis-trans* isomerization, causing motion on the surface. The absolute configuration of the four paddle-wheel units is critical in determining the unidirectional motion of the nanocar on the copper surface, which can be visualized by STM analysis.

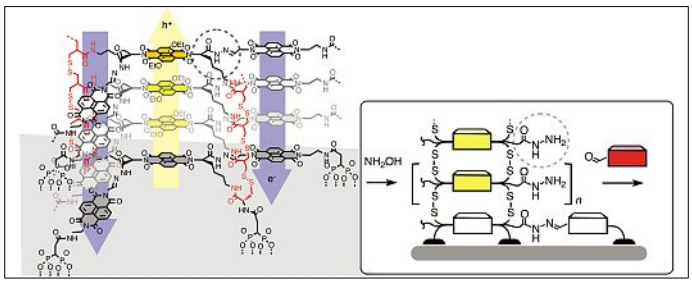
Negishi Cross-Coupling Reactions Catalyzed by an Aminophosphine-Based Nickel System: A Reliable and General Reaction Protocol for the High-Yielding Synthesis of Biaryls

R. Gerber and C. M. Frech*, *Chem. Eur. J.* **2011**, *17*, 11893.
University of Zurich
Due to its unique properties, the biaryl scaffold is an important building block in many areas of chemistry. Although palladium is the metal of choice for cross-coupling reactions, nickel-based systems have attracted much attention, in particular with aryl chlorides as substrates. The authors describe the use of $NiCl_2$ in the presence of 1,1′,1″-(phosphanetriyl)tripiperidine as a highly active catalytic system for Negishi cross-coupling reactions. With this catalyst, a large variety of electronically activated, deactivated, and sterically hindered aryl bromides and chlorides are efficiently coupled with various arylzinc reagents or their heterocyclic counterparts. The catalyst loading (0.1 mol%) is far lower than typically used for Ni-catalyzed Negishi cross-couplings.



Stack Exchange Strategies for the Synthesis of Covalent Double-Channel Photosystems by Self-Organizing Surface-Initiated Polymerization

N. Sakai* and S. Matile*, *J. Am. Chem. Soc.* **2011**, *133*, 18542.
University of Geneva
Building highly ordered and oriented architectures on surfaces is considered key for the materials of the future such as in optoelectronic devices. Ring-opening disulfide exchange can be employed to synthesize single-channel photosystems by self-organizing surface-initiated polymerization (SOSIP). To build SOSIP architectures bearing coaxial channels with molecular-level resolution, hydrazone exchange was identified as an attractive chemoorthogonal strategy. Large pores can be generated next to existing π-stacks and thereafter filled with complementary π-stacks to create *e.g.* n/p-heterojunction photosystems. This ingenious approach offers high reliability, user friendliness and thus holds promise for a variety of applications in surface derivatization.



Prepared by Nico Bruns, Valentin Köhler, Rolf Kramer, Pablo Mauleón, Fabien Monnard, Mark R. Ringenberg, and Thomas R. Ward
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