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Intrinsic Semiconducting Materials on Phthalocyanine Basis

Michael HANACK
Institut für Organische Chemie,
Lehrstuhl für Organische Chemie II,
Universitäat Tübingen,
Auf der Morgenstelle 18,
D-72076 Tübingen - GERMANY

Abstract: Stacked transition metal macrocycles $[MacM(L)]_n$ with M e.g. Fe, Ru, Os, Co, Rh and Mac = phthalocyanine (Pc) 1,2- or 2,3-naphthalocyanine (1,2-, 2,3-Nc) were synthesized. The bridging ligands (L) may be e.g. pyrazine (pyz) or s-tetrazine (tz). In general, these complexes $[MacM(L)]_n$ are insoluble in organic solvents; however, soluble oligomers $[R_4PcM(L)]_n$ can be prepared using metallomacrocycles R_nPcM, R = t-bu, et, OR, M = Fe, Ru, which are substituted in the peripheric positions. A systematic investigation of the influence of the bridging ligands on the semiconducting properties in $[MacM(L)]_n$ reveals that changing L, e.g., from dabco over pyz to tz leads to a steady increase of the semiconducting properties without external oxidative doping. Powder conductivities in the order of 0.1 S/cm can be reached by using s-tetrazine, 3,6-dimethyl-s-tetrazine (me_2tz) and others, e.g. fumarodinitrile, as the bridging ligands. The intrinsic conductivities are a result of the low oxidation potential of tz and me_2tz and due to the low lying LUMO in the corresponding bridged systems $[MacM(tz)]_n$.

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