NCN OPUS
Electron-Deficient Cyclophanes and Annulenes. Functional Aromatics in Two and Three Dimensions

Principal Investigator: Marcin Stępień, Faculty of Chemistry, University of Wrocław, Poland

In this project we propose new designs of two- and three-dimensionally organized electron-deficient aromatic macrocycles containing extended cyclophane or annulene motifs. The resulting molecular materials will be tailored as reversible redox switches, near-infrared and chiral dyes, and functional cavities. To achieve these goals, we will explore cyclophanes with π-aromatic components containing cyclic imide functionalities, which will be combined into cylindrical arrangements with variable sizes, shapes, rigidity, and symmetry. In parallel, we will develop large annulene systems stabilized by electron-deficient moieties and explore the interplay between global aromaticity and the electronic and optical characteristics of these systems. We envisage potential applications of such materials in the fields of charge storage, sensing, and electroactive devices. In particular, we will try to develop well-defined chiral motifs, capable of delivering strong circularly polarized fluorescence.

LEAD PAPERS

[1] Zhylitskaya, H.; Cybińska, J.; Chmielewski, P.; Lis, T.; Stępień, M. Bandgap Engineering in π-Extended Pyrroles. A Modular Approach to Electron-Deficient Chromophores with Multi-Redox Activity. *J. Am. Chem. Soc.* **2016**, *138* (35), 11390–11398..

[2] Kumar, R.; Chmielewski, P. J.; Lis, T.; Volkmer, D.; Stępień, M. Tridecacyclene Tetraimide: An Easily Reduced Cyclooctatetraene Derivative. *Angew. Chem. Int. Ed.* **2022**, *61* (38), e202207486. https://doi.org/10.1002/anie.202207486.

UP TO SEVEN STUDENT POSITIONS

Up to 12 months each, possible further extension. Tax-exempt scholarship: 1 500 PLN/month (undergraduates), 2 500 PLN/month (PhD students). Start date: February–May 2025.

Tasks: synthesis, spectroscopy, data analysis

Requirements:

1. Multistep organic synthesis, including microscale work, and inert-atmosphere procedures.
2. Experience with aromatic/functional dye chemistry
3. Experience with spectroscopic methods, in particular NMR spectroscopy
4. Fluency in English
5. Enrolled in the B.Sc./M.Sc./Ph.D. program at the Faculty of Chemistry UWr
6. Not employed as an investigator in other externally funded research projects.

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