

Bachelor's and Master's Theses

in

Nanodiamond Chemistry

Key words: diamondoids, preparative alkane functionalization, organic molecular electronics, new materials (surfaces, polymers), organic semiconductors



Diamondoids (nanometer-sized, hydrogen-terminated diamond hydrocarbons, nanodiamonds) are emerging as complementary materials to fullerenes and carbon nanotubes. In contrast to the latter, nanodiamonds are available in large quantities from crude oil, are chemically well-defined, and of high purity. Nanodiamonds are likely to share some of the unique properties of macroscopic diamond that are very attractive for a number of applications. One of the challenges with these novel building blocks is their selective and preparatively useful C–H bond functionalization. We have developed a variety of such approaches yielding numerous derivatives that can now be utilized for applications including platforms for organocatalysis and, in particular, organic molecular electronics.

Your B. Sc. or M. Sc. work would help us develop this chemistry further by finding ways to prepare new functionalized nanodiamonds and their use in new materials. In particular, we are interested in the topics below. You will be part of an international team working at the forefront of organic materials.

Topics:

1. Construction of a nanodiamond diode and a transistor (with Stanford University)
2. Synthesis of functionalized diamondoids for OLED applications (with Merck KGaA)
3. Computational structure and energy predictions
4. Nanodiamond phosphine ligands
5. Preparative C–H bond functionalizations

Interested? Talk to us: labs on the 5th–7th floor, OC wing

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Selected papers:

[1] *Diamonds are a chemist's best friend: Diamondoid chemistry beyond adamantane*. Hartmut Schwertfeger, Andrey A. Fokin, and Peter R. Schreiner *Angew. Chem. Int. Ed.* **2008**, 47, 1022–1036. Listed as one of the **most accessed** articles 2008.

[2] *Monoprotection of Diols as a Key Step for the Selective Synthesis of Unequally Disubstituted Diamondoids (Nanodiamonds)*. Hartmut Schwertfeger, Christian Würtele, Michael Serafin, Heike Hausmann, Robert M. K. Carlson, Jeremy E. P. Dahl, and Peter R. Schreiner *J. Org. Chem.* **2008**, 73, 7789–7792. **Highlight:** Monoprotection of Diamondoid Diols. Timothy M. Swager, Eric L. Dane *Synfacts* **2008**, 1275.

[3] *Monochromatic Electron Emission from Diamondoid Monolayers*. W. K. Yang, J. D. Fabbri, T. M. Willey, J. R. I. Lee, J. E. P. Dahl, R. M. K. Carlson, P. R. Schreiner, A. A. Fokin, B. A. Tkachenko, N. A. Fokina, W. Meevasana, N. Mannella, K. Tanaka, X. J. Zhou, T. van Buuren, M. A. Kelly, Z. Hussain, N. A. Melosh, Z.-X. Shen *Science* **2007**, 316, 1460–1462. **Highlight:** *Nature Nanotechnology* **2007**, 2, 462–463.