# Solar Energy Conversion and Energy Storage Materials

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Since the beginning of civilization, humanity has built houses to sustain comfortable living conditions throughout the seasons. In our modern society, about 50% of the total energy consumption is used for heating and cooling. Growing demands for thermal management in many different sectors, from electronics to housing, inevitably mean increased energy consumption. The primary source of heat is coming from the combustion of fossil, bio or waste-based feedstocks, all contributing to carbon emissions.

In this lecture I will present how we are working on developing molecular materials that capture, store, and release both solar and ambient heat without creating any emissions. These molecular solar thermal systems (MOST) are based on molecular photoswitches that absorb light and convert it into stored chemical energy, that can be released on demand[1-6] (Fig.1). The MOST energy system operates through different principles than traditional solar thermal and can be introduced into compact energy capture and release devices. Recently, the first example of integration of the energy storage system with photovoltaics, and in electric power generation devices was published[7]. Additionally, I will introduce materials concepts for photon upconverson (TTA-UC) and associated accelerated discovery devices.[8]

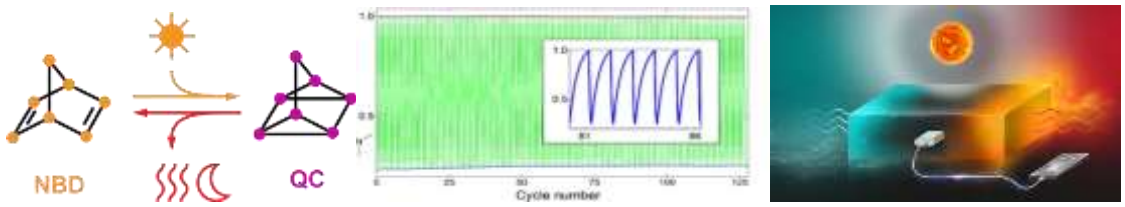


**Figure 1.** (Left)) Molecular structure of on NBD/QC photoswitch system. (Centre) Stability test performed at 60C through 127 energy storage cycles (right) Illustration of MOST power generation concept.

## References

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Kasper Moth-Poulsen is a professor and research leader in applied chemistry, currently affiliated with the Catalan Instriution for Advanced Studies (ICREA), the Polytechnic University of Catalunya (UPC), the Institute of Materials Science of Barcelona (ICMAB-CSIC), and Chalmers University of Technology, Sweden. He holds a Ph.D. in organic chemistry from the University of Copenhagen and has conducted postdoctoral research at U.C. Berkeley and the University of Copenhagen.

KMP leads a research team of ~15 PhD students and postdocs, focusing on advanced materials chemistry, molecular photoswitches, circular materials and laboratory automation. He serves as associate editor for *Journal of Materials Chemistry C* and *Materials Advances*, and is a board member at the Technical University of Denmark (DTU).

He is a recipient of several prestigious grants and awards, including ERC Starting and Consolidator Grants, the Göran Gustafsson Prize (2021), the Norblad-Ekstrand Medal (2021), and the Arnbergska Prize (2019). He is a fellow of both the Royal Society of Chemistry and the Royal Swedish Academy of Engineering Sciences.

His research has led to multiple spin-out companies, including Con-Science AB, Solartes AB, AutoSyn AB, and NanoScientifica Scandinavica AB.