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ABSTRACT:

Nanodiamond-based quantum sensing in biomedical applications

A.Mzyk¹

¹Technical University of Denmark, Kgs. Lyngby, Ørsteds Plads , 2800, Denmark.
aimz@dtu.dk

Sparkling, hard and durable, these are some of the properties commonly associated with diamonds. These qualities have made them desirable within our society for centuries. In research, the unique properties of diamonds have drawn in many enthusiasts. Particularly, nanodiamonds with crystal lattice defects such as the negatively charged nitrogen-vacancy (NV-) centers, which have emerged as powerful and versatile quantum sensors [1]. This talk focuses on a specific way to use the quantum-based sensing properties of nanodiamond with ensembles of NV- centers, a technique called relaxometry (or T1) and its application in cell biology to detect free radicals (FRs) [2]. FRs are omnipresent and one of the key players in cellular signalling. Despite their relevance, information about FRs is sparse and therefore their use as clinical biomarkers is severely limited. Since FRs are short lived and reactive, it is challenging to detect them with the state-of-the-art methodology. In my talk I will address a few exciting examples of biological processes and their clinical relevance where the role of free radicals was explored with T1 relaxometry. I will stimulate discourse on the future of nanodiamond-based quantum sensing and how it can open new perspectives in cell biology, drug screening and clinical diagnostics.

[1] A. Mzyk, Y. Ong, A.R.O. Moreno, S. Padamati, Y. Zhang, C. A. Reyes-San-Martin, R. Schirhagl, *Analytical Chemistry*, 94(1): 225-249 (2021).

[2] A. Mzyk, A. Sigaeva, R. Schirhagl, *Accounts of Chemical Research*, 55(24): 3572-3580 (2022).