Fluorescent nanodiamonds (NDs) have recently emerged as new promising imaging agents and therapeutic carriers for biological and medical applications. In particular, there is a great interest in understanding surface properties of nanodiamonds and influence of various adsorbents and coatings for robust protocols employing nanodiamonds for bio-imaging. In this talk, I will highlight two recent results focused on interaction of nanodiamonds with biological and chemical species.

In the 1st part of my talk, I will describe a robust and fast approach to coat nanodiamonds with coordination complex consisting of iron ions and tannic acid. We determine that coating of individual nanodiamonds with complexes pronouncedly enhance photoluminescence of single NV defects embedded in 60 nm nanodiamonds. In addition, the enhancement of photoluminescence is accompanied by a reduction of fluorescence lifetime providing a new opportunity for high resolution sensing. More importantly, we demonstrate an excellent signal-to-noise ratio in the ODMR signal, which is an important characteristic for single spin sensing applications. As the method utilizes biocompatible and FDA approved materials, the coating can be used with a range of bioapplications.

In the second part, I will present our recent results on development of a new type of fluorescent NDs. Specifically, we will show the utilisation of commercially available NDs with NV centres and in-house fabricated NDs with silicon-vacancy (SiV) defects for application in bio-imaging. We further modify the surface of NDs with functional groups to attach biomolecules using standard organic chemistry procedures. Therefore, we demonstrate surface functionalisation of NDs to achieve selective intracellular targeting for intracellular imaging.

In summary, our results provide an important stepping stone for the effective use of NDs for heavily sought after applications, showing that NDs are a promising biomedical research tool for cellular labelling, sensing and imaging.