

xDiamond-based Nanomedicine: Targeted Cancer Therapy and Imaging

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Nanodiamond (ND) surfaces possess faceted architectures that mediate a broad array of marked improvements to drug delivery such as enhanced cancer treatment efficacy and safety. In particular, ND surfaces can prevent early anthracycline elution, resulting in markedly decreased side effects *in vivo*, while sustained elution and increased retention results in increased therapeutic activity. Furthermore, their surface electrostatic properties have mediated among the highest magnetic resonance imaging (MRI) contrast efficiencies ever reported. NDs can also be functionalized with a broad array of therapeutic compounds such as small molecules, proteins/antibodies, and DNA/siRNA for applications in cancer treatment, cardiovascular medicine, wound healing, and beyond. In addition, NDs possess uniform dimensions (~2-8 nm in diameter per particle) and material stability that are coupled with observed biocompatibility *in vitro* and *in vivo*. Furthermore, NDs can be scalably purified and functionalized for high yield processing. Functional groups are also conducive towards facile, application-dependent molecular conjugation onto the diamond surface for integrative targeting, imaging, and therapy. Our early studies have confirmed robust drug binding to NDs through transmission electron microscopy (TEM) and Fourier transform infrared spectroscopy (FTIR) coupled with *in vitro* tracking of cellular internalization and quantitative demonstration of favorable cell response through quantitative real time polymerase chain reaction (qRT-PCR) assays of inflammatory/stress and apoptosis-regulating gene expression programs. Towards the continued translational development of diamond-based nanomedicine platforms, recent work pertaining to the *in vivo* validation of ND-enabled treatment of drug-resistant tumors, synthesis of multimodal targeted ND complexes, as well as localized wound healing will be discussed.