Insights to nano-confinement and its effect on relaxivity of gadolinium based contrast agents

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Recent literature has demonstrated the possibility of producing high performance T1 MRI contrast agents by filling shortened single walled carbon nanotubes (SWCNTs) with gadolinium.[1,2] Dubbed "gadonanotubes", these constructs are stable under physiological conditions and have MRI contrast efficiencies (relaxivities) over an order of magnitude higher than clinically administered gadolinium based contrast agents. (Figure) In order to determine the source of this unexpected boost in relaxivity, we have prepared analogous materials: shortened SWCNTs filled with various gadolinium chelates. Our results indicate that a similar increase in relaxivity occurs only upon encapsulation of the gadolinium species within the SWCNTs, suggesting the phenomenon is due to nanoconfinement.[3] Furthermore, differences in relaxivities between the gadolinium chelates used suggests the ability to modulate water access to the gadolinium coordination sphere by choice of sterically bulky ligands. These results provide new insights to MRI contrast agent design and nanoconfinement as a strategy for increasing relaxivity.

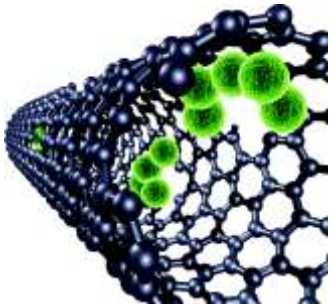

Figure: Artistic rendition of a gadonanotube

References:

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2. Sethi, R., Mackeyev, Y. & Wilson, L. J. The Gadonanotubes revisited: A new frontier in MRI contrast agent design. *Inorganica Chimica Acta* **393**, 165–172 (2012).

3. Ananta, J. S. *et al.* Geometrical confinement of gadolinium-based contrast agents in nanoporous particles enhances T1 contrast. *Nat. Nano.* **5**, 815–821 (2010).