Influence of topology, architecture, and environment on spin polarization transfer: implications for quantum information science

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Abstract: This presentation will feature mostly unpublished results from steady-state and time resolved (CW) electron paramagnetic resonance spectroscopy experiments on stable and transient radicals in unusual environments. The talk will emphasize the breadth of different structures that can be investigated, which include microbubbles, nanocrystals, metal organic frameworks, and vesicles, to learn about structural and physical properties of these systems. Significant attention will be paid to new results on spin probes studies of structured (non-Newtonian) fluids constructed from Aerosil^{TM} nanoparticles in organic solvents, seeking to understand the influence of solvent-solvent, solvent-Aerosil, and Aerosil-Aerosil interactions as a function of Aerosil loading, solvent, and temperature. Spin probe measurements in microbubbles reveal orientation effects in the outer layer of these structures for the first time. In nanocrystals we show strong evidence for the presence of radical pair triplet states. The vesicle experiments suggest new directions for small molecule topology in supramolecular systems. New experiments on spin polarization transfer from photoexcited triplet states to stable nitroxide monoradicals and biradicals as potential qubits for quantum information science applications will be described.

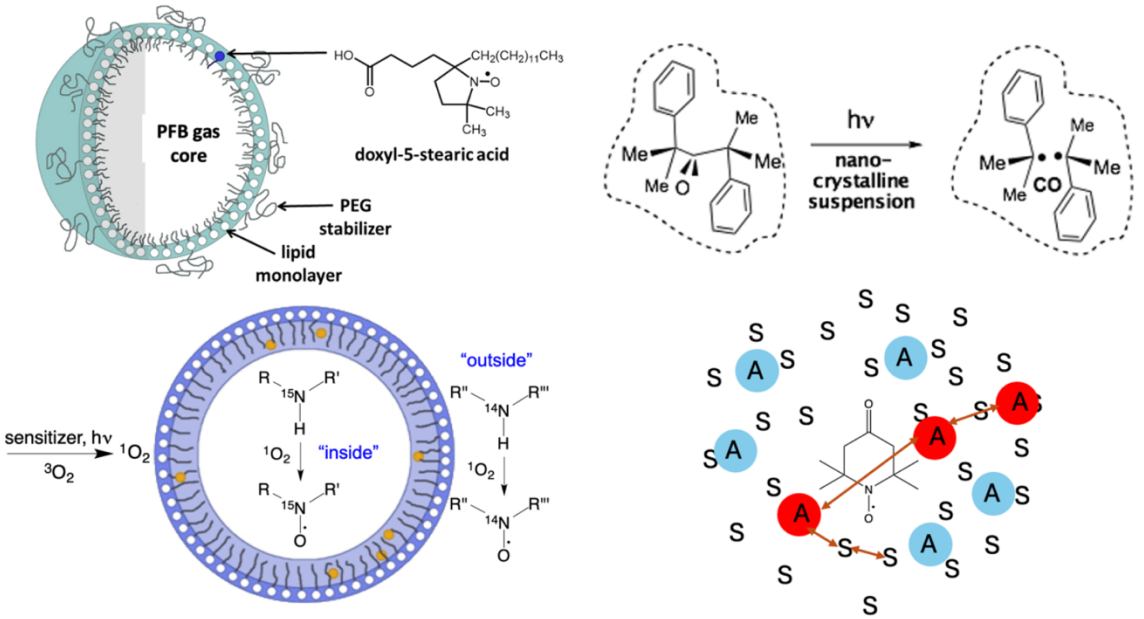

Figure 1. Top left: spin probes in microbubbles. Top right: transient radical pairs in nanocrystals. Bottom left: spin probes in vesicles. Bottom right: spin probes in Aerosil-based structured fluids.