Analytical Seminar

Thursday, Sept. 14 at 12:15 pm in Room 1315 Chemistry

Prof. Joel M. Harris

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Spectroscopy through the Microscope: Probing Liquid/Solid Interfaces within Porous Particles

Recent breakthroughs in combining spectroscopy with optical microscopy are allowing chemical analysis to be carried out with unprecedented spatial resolution (in fL volumes) and sensitivity (at the single-molecule level). In this talk, these tools will be applied to investigate the liquid/solid interfacial chemistry that governs retention of molecules within individual reversed-phase chromatographic silica particles. Confocal-Raman microscopy can be used to interrogate sub-femtoliter volumes inside of single silica particles and report interface composition through vibrational spectra of solute molecules retained at the alkyl-chain/solution interface. This method is useful both for investigating retention mechanisms, for detecting solutes that are extracted from solution and concentrated within the particle, and for characterizing the structure of stationary phase materials and their interactions with partitioned solutes. The dynamics of solute exchange are critical to separation efficiency, and as detection limits of fluorescence microscopy have reached the single-molecule level, imaging of single-molecule trajectories can be used to follow transport of individual molecules within individual chromatographic particles. This technique allows direct measurement of intraparticle molecular residence times, diffusion rates, and the spatial distribution of molecules within the particle. The observation of stuck molecule events provides direct evidence of the heterogeneity of molecular interactions with the chromatographic media, where the molecules held fixed by strong adsorption represent a major contribution to peak tailing in chromatographic elution.

Hosted by Prof. John Wright