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Using STM tip as electrochemical sensor for the characterization of bond vibration frequencies of a chemical analyte SHUAI CHANG, CHAITANYA GUPTA, ROGER HOWE, Stanford University — Traditional electrochemical interfaces are comprised of an electrically biased electrode-electrolyte interface, where charge exchange occurs between electronic energy levels of the electrode and a redox-active ion in the electrolyte. Much of the recent progress in electrochemical sensing technology has focused on enhancing the detection limit of such sensing platforms. However, much of the molecular-level chemical information describing the non-redox active species that may also be present in the electrolyte, which is encoded in the acquired current/voltage signal, is lost as background information. In this talk, a design methodology is proposed for electrochemical interfaces that are engineered from STM tips specifically to transduce information about the intramolecular bond vibrational frequencies of non-redox active molecular analytes. A quantum statistical model of a generalized charge transfer process, developed by the authors, will be presented as the underpinning for the design method. Minimization of electronic and nuclear entropy will be derived from the presented model, as the necessary condition required for resolving vibrational frequency information, and we will also describe select experimental strategies that may be implemented for total entropy minimization.

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