Superconducting transition-edge sensors (TES) for soft X-ray spectroscopy of materials at ultra-low concentrations

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We have developed and commissioned a novel X-ray spectrometer based on an array of 240-pixel superconducting transition-edge sensor (TES) array at Stanford Synchrotron Radiation Light Source (SSRL) beamline 10-1. The TES spectrometer's unique combination of high detection efficiency and high energy resolution enables us to probe the local electronic and chemical structure of ultra-low concentration active sites of interest in biology, chemistry and materials science with unprecedented sensitivity. In this presentation, I will explain the fundamental design and operation of the spectrometer, and demonstration the first X-ray emission spectroscopy (XES), partial fluorescence yield X-ray absorption spectroscopy (PFY-XAS), and resonant inelastic X-ray scattering (RIXS) of low concentration samples measured at 10-1 using the spectrometer. I will also discuss the spectrometer's capability as an R&D test bed of new TES spectrometer for X-ray free electron lasers.