New Developments in Real-Time Processing and Display of Spectra from a Multipixel Microcal X-ray Detector

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We report on a 16-pixel microcalorimeter x-ray detector that processes pulses into spectra in real time with high energy resolution. Eight of the detectors are optimized for typical energies (500 eV-8 keV) and eight of the detectors are optimized for low energies (400 eV-1500 eV). All pulses are digitally sampled at a 16 bit level, and all processing is carried out in real time thereafter. The processing chain includes baseline determination, pileup pulse rejection, digital noise filtering, pulse height fitting, and the application of pulse height corrections for the individual characteristics of each detector element. The resulting pulse heights are then combined into a histogram, calibrated in energy, which is displayed in real time.

We have tested the system out with a variety of samples typical of microanalysis in an SEM. The current system uses a closed-cycle cryorefrigerator and adiabatic demagnetization refrigerator to operate at 70 mK, and it is able to maintain the operating temperature for about 31 h. Each microcalorimeter detector element has a fully independent set of superconducting electronics, which allows us to operate at high pulse rates (~100c/s/pixel). The success of the data processing method indicates that we could extend the current system to a larger number of detectors.