VERSATILE FILTERING OF CHARGE SHARING IN COMMERCIAL SCMOS CAMERA FOR X-RAY FLUORESCENCE ANALYSIS

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The present paper reports the operational procedures of using a commercial sCMOS camera for X-ray fluorescence (XRF) spectroscopy and for energy-dispersive imaging. Initially the commercial sCMOS camera is sold for taking ordinary photos. The lowercase "s" means "scientific" because the CMOS camera is of high quality with high dynamic range and low readout noise and it is suitable for scientific research. The operational procedures of turning the sCMOS camera into an X-ray energy-dispersive imager consist of three steps. Firstly, the lens system and the glass front cover of the camera are removed to allow X-rays to pass, and an opaque front cover with an X-ray window is installed to avoid the influence of visible light. Secondly, the sCMOS camera is used in single photon counting mode, which means taking many snapshots very quickly in order to disperse X-ray photon events to different positions in images and record each photon event individually. Thirdly, an integrated-filtering method is proposed to filter out the invalid photon events of incorrect charge collection and retrieve the energy of valid photon events. In the final, the sCMOS camera becomes resolvable to X-ray photon energy, making it a powerful X-ray energy-dispersive imager. Its energy resolution is 220 eV at 5.9 keV (Mn Kα). Its size of active area is 16.6 mm × 14 mm, approximately 230 mm^2, making it suitable for some special XRF spectroscopy research in which large-area-size spectrometers are needed. It has in total 2560 × 2160 pixels and the size of each pixel is 6.5 um × 6.5 μm, making it suitable for full-field XRF imaging research in which detectors of fine pixel resolution are needed. Its frame rate can reach 33 Hz, making its capacity of count rate competent for routine XRF research in laboratory. So far, the sCMOS camera has been successfully applied to many XRF topics such as composition analysis and element-distinguishable X-ray movie imaging. Since the sCMOS camera is widely supplied on the market and the operational procedures are quite simple, it is going to contribute to much XRF research in many labs.