

## Supporting Information

Raman measurements were performed at room temperature in backscattering geometry using a Jobin-Yvon Horiba Labram HR instrument coupled to an Olympus BX41 microscope with a 50x objective using 514.5 nm laser excitation from an Ar-ion laser. An 1800 lines/mm grating spectrometer was used to acquire spectra yielding a spectral resolution better than  $2\text{ cm}^{-1}$  and spatial resolution of about  $1\text{ }\mu\text{m}$ . The laser power was maintained below 10 mW to minimize local heating and contributions from photogenerated charge carriers.

The total dopant profile (both activated and un-activated S) was monitored by secondary ion mass spectrometry (SIMS) using a Physical Electronics ADEPT-1010 instrument. The secondary ions detected include  $^{30}\text{Si}$ ,  $^{34}\text{S}$ ,  $^{29}\text{Si}+\text{N}$ , As,  $^{69}\text{Ga}+\text{As}$ , and  $^{115}\text{In}+\text{As}$  and were monitored under 500 eV Cs<sup>+</sup> bombardment incident at 60° incidence. The ions were collected from the center 20% of a  $400\text{ }\mu\text{m} \times 400\text{ }\mu\text{m}$  rastered area. To minimize charging during the analysis, the samples were flooded with low energy electrons. Stylus profilometry was used to determine the depth of the craters and calibrate the depth scale.