ROBL-CRG	**Experiment title:** Reciprocal space mapping (RSM) of Si after C implantation / formation of SiC	**Experiment number:** 20_02_009
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Report:

Silicon carbide is well known as a wide band gap semiconductor with a high thermal and chemical stability for realizing electronic devices for high frequency, high power and high temperature applications. Ion implantation of C into Si is a suitable method for synthesizing SiC. In this experiment the formation of SiC crystallites is studied if the volume concentration of C is near 0.45 of the stoichiometric value after implantation of $4x10^{17}$ cm^{-2} C ions with an energy of 195 keV at 500 °C or 800 °C. The grown particles were identified as cubic 3C polytype crystallites by x-ray diffraction; and the strain in the Si matrix and its changes were followed (see report to the ROBL experiment 20_02_001). Furthermore the orientation relation between the lattice of the SiC particles and the Si matrix is determined by the measurement of reciprocal space maps (RSM) of symmetric SiC(002) - Si(004) and asymmetric SiC(113) – Si (113) reflection pairs. An orientation alignment of the cubic axes of the SiC crystallites to the Si matrix is confirmed.

Fig. 1 shows the RSM near the SiC(002) reflection for Si(001) wafers implanted with $4x10^{17}$ cm^{-2} C ions with an energy of 195 keV. The centre of the Si(004) reflection lies at $q_{*}=0$ and $q_{\perp}=46.3$ nm^{-1}. For implantation at the lower temperature of 500 °C the cubic axes of the SiC crystallites are orientated with a nearly isotropic spread (FWHM ≈ 4.5 °) parallel to Si [001] direction.

A higher volume part of SiC grows during carbon implantation at 800 °C – the maximum intensity of the SiC(002) intensity is 3.5 times higher than in the former case. Furthermore, a more complex distribution is found (right hand side of Fig. 1): The majority of crystallites is highly aligned with a spread of 2.5 ° isotropically distributed around [001] shown by the symmetric top of the SiC peak, whereas the minority is anisotropically distributed around this axis with preferences into the <111> directions (streaks at the bottom of the SiC peak).

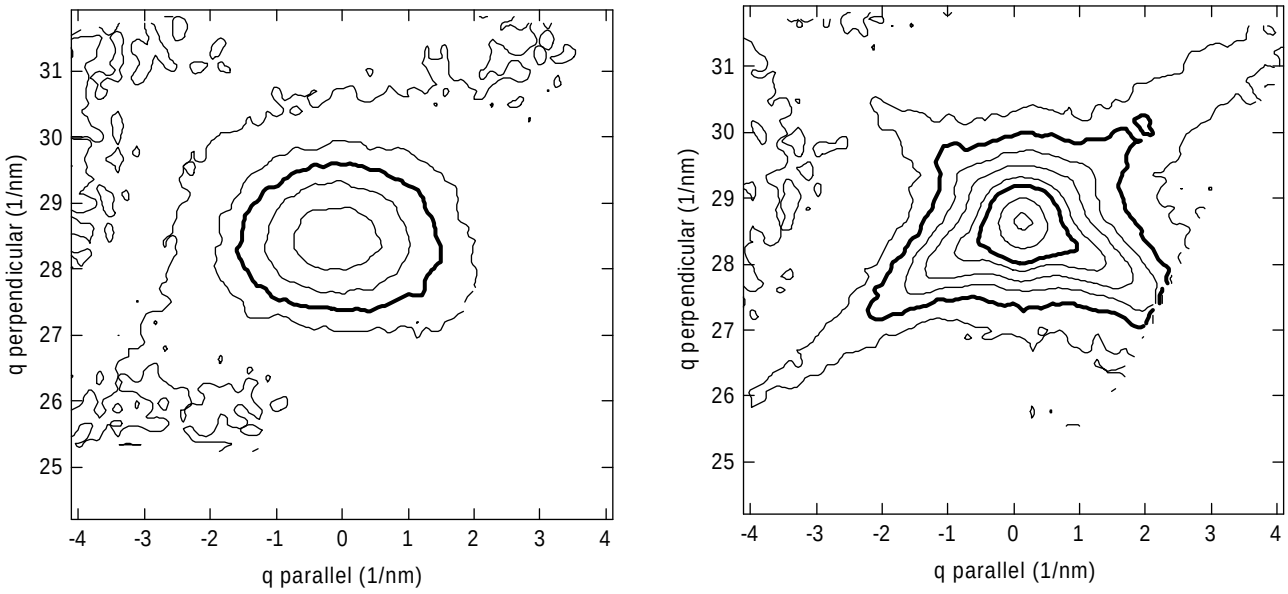

Fig. 1
Reciprocal space maps near the SiC(002) reflection for Si wafers implanted with $4x10^{17}$ cm^{-2} C^{+} with an energy of 195 keV at 500 °C (on the left) or 800 °C (on the right), respectively. The isointensity lines are choosen in a logarithmic scale, the bulk ones corresponds to 512 counts and 2048 counts per 3 sec.