# Report on the proposal entitled « Evidence for spatial correlation in radiation induced na nostructured SiC using SAXS”

## Introduction

As pointed out in the proposal, the aim of this work was to study long range correlation in materials induced by irradiation. To measure to the correlation function or more precisely the Fourier transform of this correlation function (i.e the structure factor), SAXS measurements were performed.

## SAXS results

Figure 1 displays the variation of the intensity versus the scattering vector modulus of **q** noticed q on SiC samples irradiated at different fluences. On this graph, no clear evolution of the intensity appears. From this analysis, it seems that the contrast between amorphous domains produced under irradiation and pristine SiC domains is not sufficient to extract information.

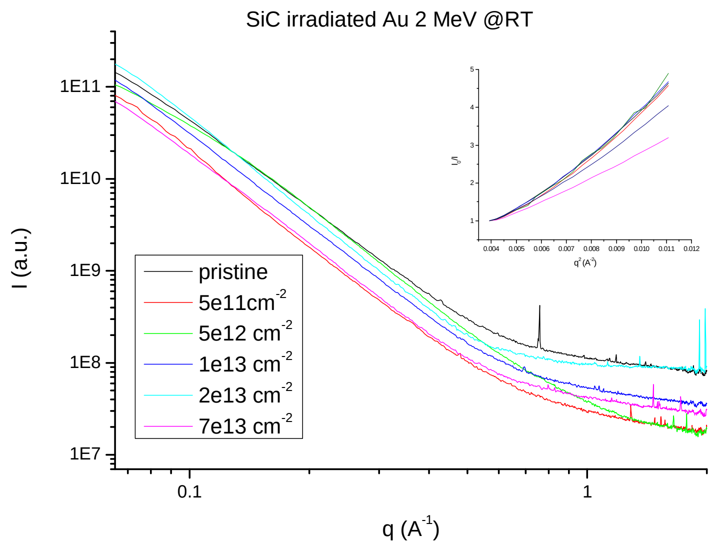


Fig .1 : Evolution of the collected intensity on D2AM collected on SiC samples irradiated by 2 MeV Au ions at different fluences. In the insert, The Ornstein Zernike representation of the collected intensity versus q is plotted.

To assess this point, The Ornstein Zernike plot is displayed on the insert of Figure 1. It appears that this plot is not a straight line as expected.

This last point implies that the transmitted intensity collected using the SAXS technique is not corrected. A part of the incident beam may scattered by the edges of the hole of the silicon wafer. The diffuse intensity resulting from this scattering may be of the same order of magnitude than the transmitted beam blurring the signal.

## GISAXS results

To overcome this problem, we performed GISAXS measurements. The main interest of this technique lies on the fact that the scattering beam is collected in reflection geometry. To collected data in GISAXS geometry, the incident angle was fixed at 0.3° during the entire collect. The X ray penetration depth associated with this incident angle is equal to 200 nanometers which is the thickness of the irradiated SiC layer.

Figure 2 displays the evolution of the GISAXS signal collected on the pristine and the most irradiated samples.

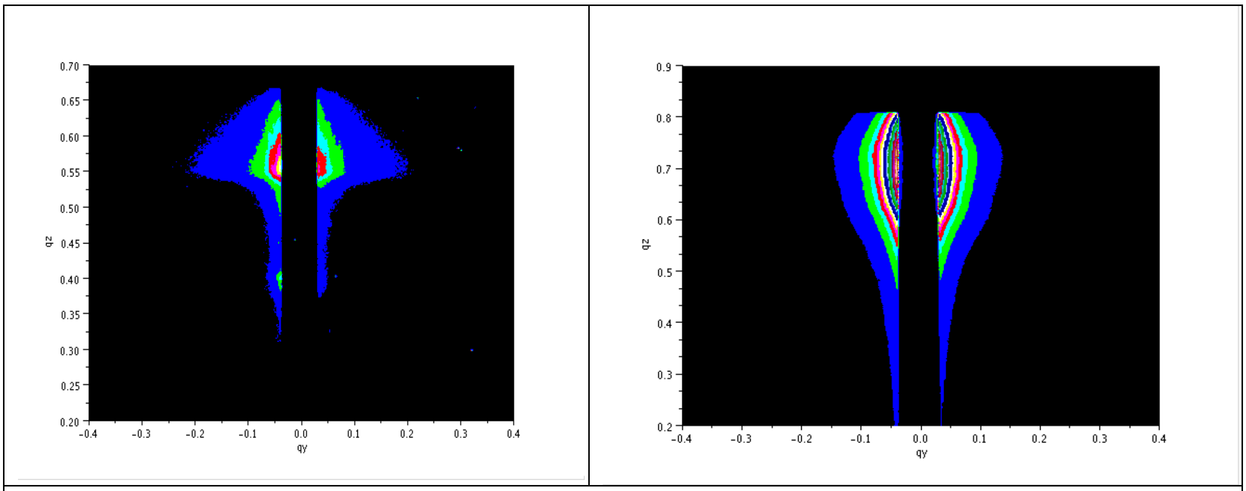


Figure 2: Scattering intensity collected on the pristine (left graph)and most irradiated (right graph) SiC layer deposited on a (100)Si wafer as a function of the components of the scattering vector **q**, qy and qz.

Despite the intensity collected on different samples are quite different, it remains up to now difficult to extract a structure factor form these graphs.

**Conclusion:**

To distinct techniques were used to track a possible correlation between different amorphous tracks induced by irradiation in SIC as pointed out by many authors. Based on recent publication (Kluth *et al*, PRL 101, 175503, 2008), we deposited tapped SiC layers of 200 nanometers thick on (100)Si wafers. We irradiated these layers with Au 2 MeV ions in order to induce an amorphization of the SiC layer avoiding any implantation of Au ions in the layer.

In order to track a possible correlation between amorphous domains created by displacement cascades, we performed:

- SAXS measurements on these layers. The diffuse scattering due to Si edges blurred the transmitted signal as displayed on figure 1.
- GISAXS measurements. Despite the variation of the collected intensity appears to be different on the pristine and most irradiated sample, the sinal has clearly not be analyzed to extract a structure factor.