Brittle crack propagation in silicon wafer by diffraction tomography

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Crack propagation in brittle materials is difficult to study due to its propagation within bulk materials and its high speed (km/s range). High penetration of hard X-rays, intense fluxes on undulator beamline ID19 and fast detectors allow one to face these challenges. We will report on the study of the crack propagation in bonded silicon wafer assemblies, a key step of the so-called Smart Cut™ technology [1] used for Silicon-on-Insulator substrates manufacturing. Crack propagates in this case along a weakened implanted layer [2].

Experiments were conducted in diffraction mode using scattering on (220) lattice planes, perpendicular to both crack propagation direction and surface normal [001]. Experiments in both 4- and multi-bunch modes have allowed a clear view of the crack front line and oscillatory behaviour of the two separated parts of the crystals in the wake of the crack propagation. Quantitative data on the post-split movements could be obtained and compared to IR data [3,4].

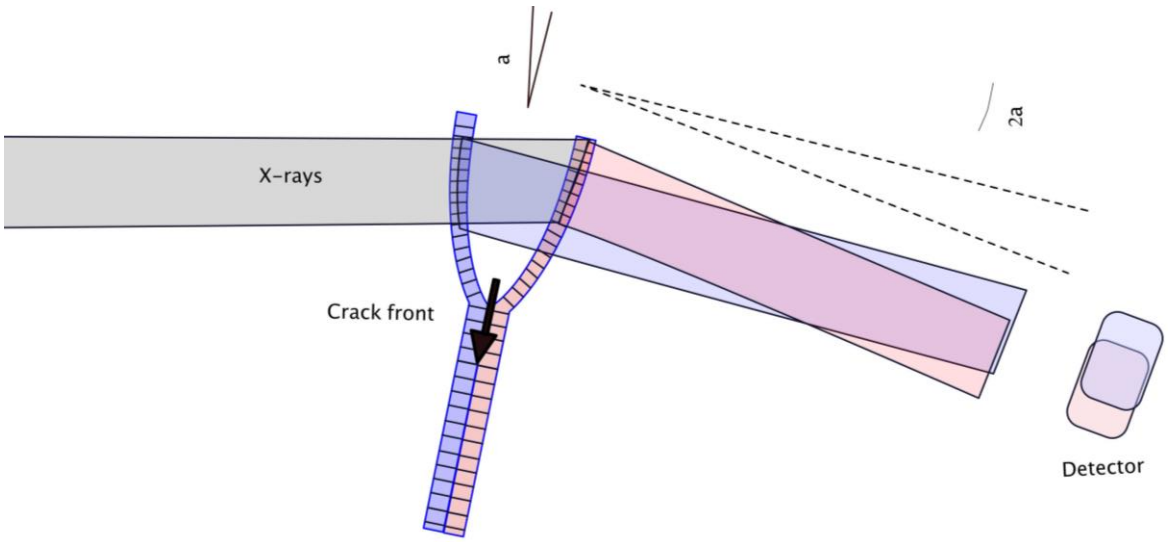

Figure. Geometry of the ID19 experiment.

References

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