The characterisation of areal density, homogeneity and edge structure of thin Ge islands, measured by proton microprobe backscattering

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Two Mev proton microbeam backsattering experiments were carried out in order to measure the absolute thickness, uniformity and the structure of the edges of thin (300 nm) Ge islands (500 μm diameter) that were were evaporated on a commercial PIN diode in a polkadot pattern. A ~1μm beam size was used, and line scans and maps were generated to determine the shape and uniformity of the Ge distribution. As for a 2 MeV proton beam the thin target approximation may be applied with negligible error, no stopping power values are needed in the thickness determination. However, in order to determine the beam fluence precisely, a simultaneous measurement of a Pt thin film standard was performed, allowing the determination of the Ge thickness within ~5%.

These structures are used in the accurate determination of heavy ion stopping powers [H. Timmers, K. Stenström, M. Graczyk and H.J. Whitlow, Nucl. Instrum. and Methods B(2004) in press)]. Upon heavy ion irradiation, the PIN diode registers the energies of ions that have traversed the Ge island and simultaneously the energies of those ions who impinged on the bare diode surface, thereby allowing the determination of the energy loss in the Ge. If the absolute thickness of the stopping medium is known, the stopping power can be established with high precision.