



Mechanisms of Ion Beam Synthesis

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Ion beam synthesis of buried layers of silicides or dielectrics is known to depend strongly on such conditions as the incoming ion fluence, flux and temperature. From the fundamental point of view, ion beam synthesis can be divided into (1) nucleation and growth, and (2) OSTWALD ripening and coalescence. BOTH processes (as shown here) occur IN BEAM. We have studied stage 1 experimentally for CoSi₂ via *in situ* transmission electron microscopy during 50 keV Co ion implantation. We also performed a computer simulation of the experiments, based on the LIFSHITZ-SLYOSOV-WAGNER theory of OSTWALD ripening, extended by including a source term (implanted ions) and the possibility of nucleation events. The computer simulation allows the identification of the mechanisms controlling the precipitate evolution: Flux dependent nucleation rate at the initial stage of ion implantation and, later on, reduced precipitate production due to a precipitate density dependent Co supersaturation. Post-implantation annealing of a layer of SiO₂ precipitates has been described by OSTWALD ripening of a spatially inhomogeneous system explaining the experimentally observed multiple layer structuring of implanted distributions. Finally, we present a new method to produce nano-wires and dots of CoSi₂ based on local melting of Co implanted regions and a subsequent concentration of Co due to strong segregation during epitaxial resolidification.

Supported by the PROCOPE program^{1,2} and by the Bundesminster für Forschung und Technologie¹ through contract 211-5291-03-HE3ROS.