Suppression of Charge Build-up during Ion Bombardment into Insulators using a Cluster Ion Beam

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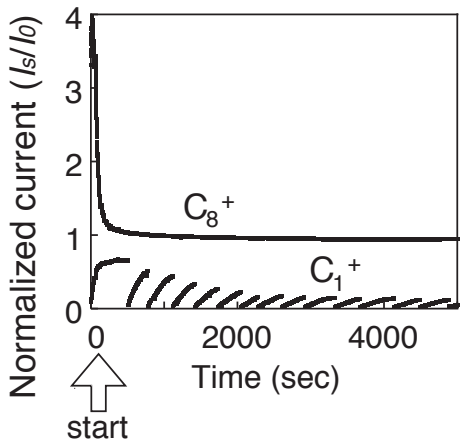
The charge accumulation processes of an organic insulator during monoatomic ion C_1^+ and cluster ion C_8^+ bombardments were studied by simultaneously measuring the target and secondary emission currents as functions of atomic dose. A series of abrupt changes in the currents was observed during C_1^+ bombardment, indicating repeated charge accumulation and electric breakdown. In contrast to the C_1^+ bombardment, the emitting current was equilibrated with the injecting current and the electric breakdown was not observed for C_8^+ bombardment. Combining the cluster bombardment with the application of the external electric field eliminates the charge accumulation problem. Cluster ion beam is expected to be useful for the processing and analysis of materials having low electric conductivities.



Variations of secondary emission current I_s normalized to incident beam current I_0 (I_s/I_0) with irradiation time for monoatomic ion C_1^+ and cluster ion C_8^+ bombardments to polycarbonate.

Silicon Nanoblocks Pave The Way for A New Conceptual Nanoarchitecture

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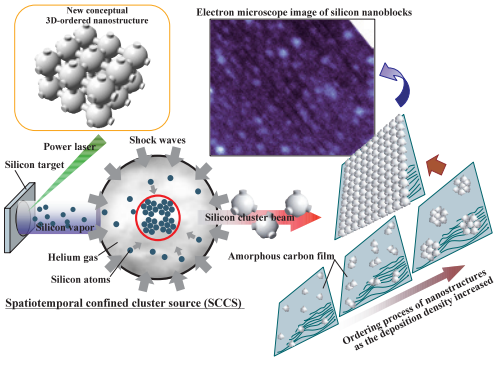
"Nanoarchitecture" in blocks of atomic clusters uniquely enables one to construct new conceptual three-dimensionally ordered nanostructures efficiently. Spatiotemporal confined cluster source (SCCS) has been newly developed to realize the nanoarchitectures using stable clusters which have characteristically narrow size distributions. Electron microscopic images of well-defined silicon clusters deposited on an amorphous carbon film revealed that silicon nanoblocks of 2-3nm in diameter lined up spontaneously to form a tetragonal structure by the interaction potential working on between adjacent silicon clusters. The empirical establishment of spontaneous ordering of nanoblocks paves the way for the three-dimensional nanoarchitecture in blocks of clusters, which particularly extends electronic, optical, and mechanical functions of nanomaterials.

3D-ordered silicon nanoblocks possibly generate a monochromatic electron emitter, which would lead to the increase of resolution of electron microscopes or lithography systems, and also possibly turn ultra thin accumulators with a high electric capacity into reality. The accumulator integration system with a solar cell can change the concept of autonomous energy supply systems which are now expected as a short term operating system.



Cluster beam nanoprocesses to realize nanoarchitecture in blocks of atomic clusters.