Monte Carlo simulation of the secondary electron yield of an insulating target bombarded by a defocused primary electron beam.

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Abstract

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The time evolution of the secondary electron emission yield of an insulating target is not only related to the primary electron beam characteristics but depends also on the properties of the traps present in the material. To study this phenomenon, we have developed a simulation model based on the Monte Carlo method, that enables us to follow completely the history of the charge carriers. In this work, we have restricted our study to the case of a broad primary electron beam (defocused mode) so that this problem can be described by using a simplified one-dimensional model. The aim of our simulation is to clarify the role played by the traps in the dynamics of the charge of the system as a function of the implanted dose. Parameters, such as the volume density or as the activation energy of the traps, play a key role in the establishment of the internal electric field and thus on the evolution of the secondary yield. Two extreme behaviours can then be identified. In a first case, the charge carriers are deeply fixed in the trapping sites and the electric field due to this charge distribution can alter strongly the secondary emission. In the second case, the localization of the carriers is not sufficient to fix the charges in the sample. One then notes the appearance of a current corresponding to the evacuation of the injected electrons towards the mass. The evolution of the secondary yield is then stopped.