

Self-organized nanopatterning of silicon surfaces by ion beam sputtering

J. Munoz-Garcia, L. Vázquez, M. Castro, R. Gago, A. Redondo-Cubero,
A. Moreno Barrado, R. Cuerno

Abstract— In recent years Ion Beam Sputtering (IBS) has revealed itself as a powerful technique to induce surface nanopatterns with a large number of potential applications. These structures are produced in rather short processing times and over relatively large areas, for a wide range of materials, such as metals, insulators, and semiconductors. In particular, silicon has become a paradigmatic system due to its technological relevance, as well as to its mono-elemental nature, wide availability, and production with extreme flatness. Thus, this review focuses on the IBS nanopatterning of silicon surfaces from the experimental and the theoretical points of view. First, the main experimental results and applications are described under the light of the recently established evidence on the key role played by simultaneous impurity incorporation during irradiation, which has opened a new scenario for an improved understanding of the phenomenon. Second, the progress and state-of-art of the theoretical descriptions of the IBS nanopatterning process for this type of targets are discussed. We summarize the historical approach to IBS through simulation techniques, with an emphasis on recent information from Molecular Dynamics methods, and provide a brief overview of the earlier and most recent continuum models for pure and compound systems.

Index Terms— Ion beam technology; Nanopatterning; Silicon; Co-deposition

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