ФИЗИКА КОНДЕНСИРОВАННЫХ СРЕД

COMPUTATIONAL MODELING OF MAGNETRON SPUTTERING FOR THIN-FILM MATERIALS: OPTIMIZING DEPOSITION AND ANALYZING MORPHOLOGY

Abdelkader Bouazza

Thin-film layers are commonly produced via magnetron sputtering, with experimental exploration typically aimed at determining optimal deposition conditions and understanding the relationship between film quality and deposition parameters. Despite the benefits, traditional experimentation poses drawbacks such as time and cost constraints. Hence, employing efficient simulation models is recommended to streamline processes, save resources, and enhance accuracy. This article focuses on developing a computer simulation model for magnetron sputtering deposition, particularly targeting semiconductor materials like silicon (Si) and germanium (Ge) used in modern photovoltaic cells, as well as common electronic components like copper (Cu) and silver (Ag). The simulation model, employing Monte Carlo analysis, accurately predicts thin film deposition and thickness while considering factors such as ejected atom flow, energy, direction, and collision dynamics. The impact of target-substrate distance on deposition performance is also investigated. Comparative analysis between our simulation data and previous works validates the efficacy of the proposed model.

Keywords: Monte Carlo simulation, Sputtering process, Thin-films deposition, semiconductors, modern materials, electronic components, photovoltaic cells.

Поступила в редакцию 1 июля 2024 г.
После доработки 14 июля 2024 г.
Принята к публикации 15 июля 2024 г.

L2GEGI Laboratory, University of Tiaret, 14000 Tiaret, Algeria; e-mail: abdelkader.bouazza@univ-tiaret.dz.