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Cleaning level of the target before deposition by reactive direct current magnetron sputtering

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Abstract

We present a thorough study of the target-cleaning phase to estimate the healthiness of the target in a direct current (DC) magnetron sputtering deposition. The study is based on real-time plasma monitoring by means of optical emission spectroscopy during a traditional cleaning phase in an Ar atmosphere. In this work we demonstrate that intensities of Ar emission lines are sufficient indicators of the target cleanliness degree. To derive these results SiO_xN_y thin films were grown by reactive DC magnetron sputtering on silicon wafers for different deposition configurations of Ar, O_2 and N_2 fluxes. Refractive index of the resulting films is measured by in-situ spectroscopic-ellipsometry. A simple but robust estimator is used to determine the time when the target is ready to start deposition. Hence, this approach can be suited for an industrial environment since the time invested in the cleaning phase can be minimized avoiding the waste of material and time.

Keywords: Magnetron sputtering; Target-cleaning; Poisoning; Optical emission spectroscopy; Optical properties; Thin films.

1. Introduction

Magnetron sputtering is a well-established technique used to produce a wide variety of thin films made from different materials and to pursue different applications [1-5]. One of the most interesting operation modes is reactive sputtering deposition since allows controlling the stoichiometry of the resulting compound by manipulating a few parameters of the process like gases concentration and chamber pressure [6, 7]. Therefore, by the use of reactive atmospheres it is possible to produce coatings with different physical characteristics to those of the original target material. While sputtering is a cost-effective technique for scientific and industrial applications it has several drawbacks like hysteresis effects and target poisoning [8-12].

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