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Depth profiling of alumina thin films using laser induced breakdown spectroscopy: structural and morphological dependence

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Abstract

Laser induced breakdown spectroscopy (LIBS) is a relatively new technique that is being applied to thin films characterization as an alternative to the current conventional depth profiling methods. As it is well known, the laser-induced plasma is a micro source of light that can be analyzed spectroscopically in order to obtain the characteristic spectral lines of the elements in the sample surface. In depth profiling, focused laser pulses are fired repetitively onto the same spot of the sample surface, and the depth is related to the recorded consecutive spectra. In this study we are presenting the results of experiments carried out on the depth profile analysis of alumina coated silicon substrate using LIBS technique. The aluminum and silicon spectral emission lines were measured in the LIBS spectra using the fundamental wavelength (1064 nm) of the Nd: YAG laser. The concepts of the determination of the coating thickness and chemical composition are presented and the effect of thin films structure and surface roughness has been discussed.

1. Introduction

Characterization of surfaces and depth profiling of thin layered materials became of a great interest in the analytical chemistry field. Furthermore, a number of aspects about the composition and properties of the layers can be investigated. In addition to the elemental composition determination, the identification of the location of the interfaces in multilayered materials and thin films is challenging [1]. Several techniques, separate or combined, can be used for this task. Among these are accelerator mass spectrometry (AMS) [2], Rutherford back-scattering (RBS) [3], scanning tunneling microscopy (STM) [4], Auger electron spectroscopy

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