Characterization of Preferred Orientation Controlled Giant Grain Growth Behavior of Platimun Films on Silicon and Sapphire Substrates by Reactive Magnetron Sputtering

Jung-Hae Choi
Seoul National University - Korea

Abstract

Platinum films were deposited by reactive magnetron sputtering on Silicon and sapphire substrates. Argon-oxygen sputtering gas mixtures were used to control the microstructure and the preferred orientation of platinum films. Post-sputtering anneal was done at 600 1,000C range in air to study the effects of the incorporated oxygen during sputtering on the grain growth behavior of platinum films. After sputtering and anneal at optimum conditions, the 1-m thick Pt films completely transformed to giant grains with sizes as large as several centimeters. Furthermore, the preferred orientation of the giant grains could be controlled to either (111), (200), (220), or (311). It is suggested that the incorporated oxygen in the Pt lattice during the sputtering plays an important role in the giant grain growth of Pt films. By using the giant grain growth of platinum films, temperature sensors and heaters with superior properties were fabricated. Furthermore, the giantly grown single crystal platinum films are also proposed as a possible substrate for heteroepitaxy of diamond wafers for the application of the future high output power, high-frequency diamond semiconductor devices. The aim of this study was to analyze and explain the microstructural characteristics of giantly grown Pt films during post-sputtering anneal. For this, microstructures were observed by optical and scanning electron microscopy and the preferred orientation was determined by electron backscattering diffraction (EBSD) and x-ray diffraction. The main focus of this investigation was the control of the giant grain size and the preferred orientation of platinum films.