

Annealing time effects on the surface morphology of C–Pd films prepared on silicon covered with SiO₂

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Morphology changes of C–Pd films prepared in physical vapor deposition (PVD) process and next annealed in a temperature of 650 °C during different time were studied. These studies were performed with electron microscopy methods (scanning SEM and transmission TEM). It was found that not annealed films are flat and they are composed of grains with composite character and size of 100–200 nm. Pd nanocrystallite of a diameter of a few nanometers in some carbon matrix was placed in these grains. For annealed films, a formation of palladium nanograins with different sizes and shapes as well as a porous carbon matrix were observed. High resolution TEM investigation was used to determine a structure of all these grains. An increase in duration time of annealing process led to diminishing of the porosity of carbon matrix and a number of Pd grains situated on the film surface. It was also stated that covering of Si with SiO₂ layer prevents formation of palladium silicide.

Keywords: Pd, carbon, film, SEM, TEM.

1. Introduction

The surface morphology of the sensing layers closely influences the sensitivity of a gas sensor. Various groups have attempted to expand the surface area of the gas sensing layer using various photolithographic techniques and advanced materials such as carbon nanotubes or nanostructural films. Although these reports gathered considerable interest because of the faster response times of the resulting gas sensors, these materials present poor recovery periods at room temperature while sensing toluene, CO, CO₂, NO_x, hydrogen and other gases. Especially palladium is widely used as a sensing material because of its great affinity towards hydrogen [1–3] and other gases and compounds (*e.g.*, as Pd nanoparticles incorporated into a polymer or