Carbon 2006, 44(11), 3091–3101

Deposition rates during the early stages of pyrolytic carbon deposition in a hot-wall reactor and the development of texture

V. De Pauw[a], A. Collin[a], W. Send[a], J. Hawecker[a], D. Gerthsen[a], A. Pfrang[b], Th. Schimmel[b]

[a] Laboratorium für Elektronenmikroskopie, Universität Karlsruhe (TH), D-76128 Karlsruhe, Germany

[b] Institut für Angewandte Physik, Universität Karlsruhe (TH), D-76128 Karlsruhe, Germany

Abstract

Pyrolytic carbon layers were deposited from methane/oxygen/argon mixtures on planar substrates (silicon wafers) at a total pressure of 100 kPa, a maximum gas residence time of 2 s and a temperature of 1100 °C. The depositions were performed in a hot-wall reactor with the substrate oriented parallel to the gas flow. Particular attention was paid to factors that influence the reproducibility of the deposited layers. Scanning and transmission electron microscopy were applied to study the thickness profiles and the texture of the carbon layers. The surface topography was investigated by atomic force microscopy. For pyrolytic carbon deposited without oxygen, an alteration from medium- to high-textured carbon is observed with increasing residence time. Islands are observed on the surface of the layer whose size increases with the texture. For pyrolytic carbon deposited with 3% oxygen, lower deposition rates were obtained and a strong modification of the texture is found compared to gas mixtures without oxygen.

Key Words

Pyrolytic carbon; Chemical vapor deposition; Electron microscopy; Atomic force microscopy; Texture.