Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C2-018

Diamond growth in air at room temperature in CVD-grown pseudo-graphite films

I M Shmytko, O V Misochko and **S K Brantov**
Institute of Solid State Physics - RAS, Russia

Attempts have been made to develop a simple and fast technique of producing diamond-like films by chemical vapor deposition (CVD) via methane pyrolysis at ~1270-1420 K using a simple reaction cell in the form of a capacitor. Under the impact of electric field ~ 10^{-2} V/μm the carbon condensed onto single crystal silicon substrates placed between the capacitor graphite plates. However, applying this technique we obtained instead of diamond-like films, pseudo-graphite films with graphitization index of ≈0.44. The films were extremely brittle, easily ground in an agate mortar into nanopowder with grain sizes of several tens of nanometers and demonstrated micro hardness comparable to that of diamond (~70-90 GPa). They also exhibited a pronounced texture in the direction of the film normal coinciding with the graphite c-axis and consisted of nanocrystallites with average size <D>≈7 nm. Moreover, the films turned out to be highly inhomogeneous with local lattice parameter variations Δc≈0.22 Å (Δc/c≈ε=3.15%). After ~ 2 years this film aged in a normal atmosphere at room temperature have undergone considerable and, in our opinion, unique variations. Researches on the film by XRD, Raman spectroscopy and SEM methods showed that for the aging their structure has changed. The main products of the interaction of the films with the atmosphere turned out to be carbide of silicon and carbon in the form of micro crystalline diamond of high perfection, see fig.1-b. The mechanism reconstruction of pseudo-graphite film into the silicon carbide and diamond is discussed.

shim@issp.ac.ru