GRAPHENE- AND GRAPHITE-LIKE THIN FILMS FROM AMORPHOUS CARBON COATINGS

Kaindl, R.[1], Pichler, J.[2], Fischer, R[2]., Jakopic, G[1] & Waldhauser, W [1]

[1]JOANNEUM RESEARCH, MATERIALS – Institute for Surface Technologies and Photonics, Leobner Straße 94, A-8712 Niklasdorf, Austria

[2]Graz University of Technology, Institute of Inorganic Chemistry, Stremayrgasse 9/IV, A-8020 Graz, Austria

e-mail: reinhard.kaindl@joanneum.at

Graphene, a flat monolayer of carbon atoms bonded in benzene-type *sechser* rings with outstanding physical and chemical properties, is subject of intense basic and applied research. This study presents attempts to produce graphene-graphite like thin films by modification of amorphous carbon (a-C) coatings with thermal and plasma treatments (Figure 1), deposited on various substrate materials.

The coatings were deposited by plasma enhanced chemical vapour deposition (PECVD) from C_2H_2 and subsequently etched in Ar plasma and by physical vapour deposition (PVD), using magnetron sputtering from a carbon target. Substrates were Si, Si with a 100 nm thermal SiO_2 layer and Cu and Ni foils. Some coatings were tempered in a nitrogen-filled tubular furnace at 300 ° and 800 °C for 8 hours, 15 minutes, respectively.

Refraction index and absorption coefficient of a PECVD coating deposited at 3 kV accelerating voltage and ion etched at 800 eV are similar to reported data for graphene and graphite. Raman carbon band parameter yielded a G position and full width at half maximum around 1582-1592 and 102-108 cm^{-1} and I_D/I_G intensity ratios 1-1.6 for etched and tempered PECVD coatings on SiO_2 and sputtered PVD coatings on Cu foils. This suggests a transition from a-C to nanocrystalline graphite with an in-plane correlation lengths <1 nm, almost purely sp^2-coordinated network, partly odd membered rings and complete absence of short carbon chains.

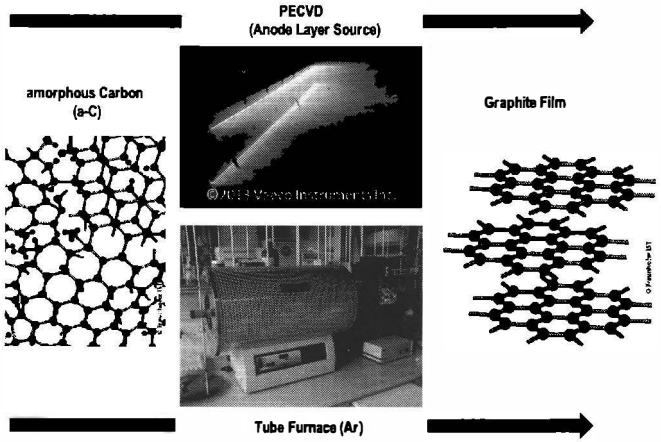

Figure 1. Idea of deposition of PECVD a-C coatings and modification by ion etching and thermal treatment.