EPR SIGNAL OF CARBON FILMS ON SOME SUBSTRATES

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Recently, researchers have shown an increased interest in the development of technologies for applying thin carbon films on various materials [1-4]. To obtain such films, various types of substrates are selected, for example, such as: quartz, glass, crystalline and monocrystalline silicon, etc. Depending on the synthesis temperature, localized carbon can be represented both in the amorphous state and in the nanocrystalline state.

Films were obtained on an AX5200S – ECR equipped with a microwave radiator for plasma excitation firms of by Seki Technotron Corp. A darkish color carbon films is formed on substrates of Si, mica and quartz during plasma decomposition of a mixture of CH_4 and H_2 and carbon deposition. In our case, the time of deposition of carbon on the substrate with the formation of a film was 2 hours on excited of plasma in a mixture of CH_4+H_2+A_r at a pressure of $3,8\cdot10^{-2}$ Torre. The microwave power supplied to the chamber was 540 W, and the reflected power was 84W, the leakage into the chamber of CH_4 and H_2 was the same and equal to 20 cm^3/min.

EPR spectroscopy of the sample as the secondary bivalent manganese ions in the lattice is often used a magnesium oxide (Mn^{2+} in MgO). As a reference sample were used Mn^2 + ions in MgO. The signal from the sample under investigation was recorded between the 3rd and 4th components of the six-coil spectrum from Mn^{2+}.

Table 1 shows the dependence of the g-factor of EPR signal on the temperature of carbon films on different substrates at perpendicular arrangement of plane of sample relative the orientation of the and parallel magnetic field. The research has also shown that at measuring both orientations of the magnetic field the dependence of the EPR signal for silicon has a jumplike form. This means that an unpaired electron is localized on a non-carbon atom and deviations at temperatures of 300^0C ($g_\perp\approx2,00249$ and $g_{||}\approx2,00221$), at 450^0C ($g_\perp\approx2,00225$ and $g_{||}\approx2,00221$) and at 550^0C ($g_{||}\approx2,00281$). These deviations of the g-factors (*$g_{//}$ and $g_\perp$)* in both orientations of the measurement strongly depend on the impurities of the samples [5].

This study has identified the dependences of the intensities of the EPR signal, the g- factor and the line width on the temperature of carbon films on various substrates with perpendicular and parallel arrangement of the sample plane relative to the orientation of the magnetic field are presented.

Table 1: Parameters of the g-factor at different arrangement of sample of carbon films on various substrates

T, ^{0}C	$g_{\|\|}$- factor			$g_{\perp}$- factor		
	Quartz	Mica	Silicon	Quartz	Mica	Silicon
0	2,00283	2,00279	2,00264	2,00287	2,00293	2,00264
200	2,00292	2,00293	2,00249	2,00291	2,00319	2,00249
300	2,00304	2,00297	2,00221	2,00301	2,00293	2,00221
400	2,00324	2,00303	2,00257	2,00292	2,00288	2,00257
450	2,00311	2,00292	2,00278	2,00303	2,00238	2,00225
500	2,00302	2,00293	2,00294	2,00302	2,00303	2,00237
550	2,00326	2,00313	2,00281	2,00318	2,00313	2,00364
600	2,00319	2,00306	2,00304	2,00292	2,00326	2,00304
700	2,00329	2,00332	2,00303	2,00304	2,00322	2,00306
800	2,00327	2,00301	2,00303	2,00327	2,00292	2,00303

The research has also shown that with increasing temperature, the normalized intensity of the EPR signal line increases when carbon is deposited on various substrates (quartz, mica and silicon) by the method of plasma decomposition of a mixture of CH_4 and H_2. One of the more significant findings to emerge from this study is that the presence in the composition of carbon films of various forms of graphite with a certain degree of crystallinity. The findings of this study have a number of important implications for future practice.

Reference

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