

SYNTHESIS AND CHARACTERIZATION OF SP² CARBON FILMS BY CVD METHOD WITHOUT CATALYST SUBSTRATES

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Resumo

This work aims to study graphene synthesis via Chemical Vapor Deposition - CVD, without using metallic catalysts. We were able to grow the films directly on a SiO₂/Si substrate (oxide thickness of 300 nm). We demonstrate that the growth of graphene without catalysts is not self-limiting, that is, the film thickness is strongly dependent on the growth time. We investigated different deposition times and we observed significant differences in the thickness and coverage of the films. With longer synthesis time, we observed that the films tend to be less crystalline, despite better coverage. In order to obtain more crystalline films and with complete coverage of the substrate, we developed the method of pulsed gasses. This method is innovative, since we are not aware of other works in the literature with application of this method. The pulsed flow of gasses consists of a growth with curing times along the deposition, when the insertion of the carbon precursor (CH₄) is interrupted by periods intercalated along the growth. We performed 3-hour syntheses for pulsed flow and tested three annealing times: 1 min, 3 min and 5 min. For the shortest annealing time, we had films similar to continuous flow growth, and for the longest annealing time, we did not observe any carbon deposition. The deposition with 3 min provided films with better quality when compared to films deposited with continuous CH₄ flow. The characterization of our films was performed by scanning electron microscopy (SEM), Raman spectroscopy. To exemplify in practice the interest of this type of synthesis, we made a field effect transistor using samples grown with continuous and pulsed flows of gas. In these measurements, we observe the variation of the Fermi level, the increase in current and the conductivity of the synthesized materials.

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