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The influence of growth time on the defects of multilayer graphene obtained by pecvd

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Graphene has chemical and physical properties that are attractive for different applications. Therefore, graphene stands out in research, which focuses on producing graphene with high quality. The quality of graphene is directly related to growth parameters, such as gas mixtures, temperature, and time. Conventional methods used to obtain graphene, such as chemical vapor deposition (CVD), produce graphene with fewer defects with increasing growth time. However, high temperatures are required, reaching up to 1000° C. However, graphene can also be produced at low temperatures using the Plasma-enhanced Chemical Vapor Deposition (PECVD) method, so it is an exploration method for producing carbon nanostructures. For this reason, the objective of this work is to obtain graphene from the PECVD method with a DC-pulsed source. The growth was carried out on the nickel substrate with a mixture of argon, hydrogen, and methane gases, with 700 V of tension, and a temperature of approximately 400° C, and the study of the time was carried through with the variation of 5 to 30 minutes of growth. The obtained nanostructures were characterized by Raman spectroscopy. The Raman spectra showed characteristic bands of carbon-based materials, with D, G, and 2D bands at all times studied. The growth time of the nanostructures directly influenced the intensity of the D band, which is related to the defects. It also influenced the width at half-height of the 2D band (FWHM (2D)). The increase in time to 15 minutes of growth reduced the intensity of the D band, evidencing the reduction of defects along with the structure. However, at times longer than 15 minutes, there was an increase in the intensity of the D band, in addition to an increase in FWHM (2D), indicating a greater amount of graphene layers. The results obtained by Raman spectroscopy characterize the formation of defective multilayer graphene. However, the material obtained with the growth of 15 minutes was the time that presented the least amount of defects in relation to the other times studied. This fact shows the importance of the growth time parameter in the quality of the multilayer graphene structure obtained by PECVD.