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Towards an optical in-line characterization of nano petals

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ABSTRACT

Carbon Nano Petals (i.e. CNPs) are cantilevered multilayer grapheme sheets that are seeded from core graphite fibers. The resulting structure offers a possibility of minimizing interfacial losses in transport application, improved interactions with surrounding matrix materials in composites, and a route toward substrate independence for device applications. The mass production of CNPs on the substrate required a method that can provide synchronous feedback on the sample status without pulling them out of the production line. Different optical properties can be observed when surfaces with different roughness are illuminated with a highly coherent light such as a laser beam. Similarly, CNPs in different growth periods should give distinguishable statistical feathers in their optical signatures, such as speckle size distribution, average speckle size, and speckle contrast. A prototype inline inspection system is developed which can inspect small area with a 45 degree interrogation light and capture speckle patterns at 90 & 135 degrees. Two different methods, Auto-correlation and Matlab digital image processing (DIP), are used to analyze the raw images in terms of average speckle size and speckle size distribution. It is found that saturated signal is only detected in the case of 135 degrees on the CNT sample without petals. As the distance between the camera and CCD increases, the average speckle size increases. Also, there is a positive correlation between the average speckle size and the wavelength. This prototype system is capable of providing real-time growth characteristics of CNPs from roll-to-roll production facilities.

KEYWORDS

Carbon Nano Petals, in-line inspection, speckle interferometry