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Nucleation and growth of diamond films by using HF CVD technique

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Diamond films were deposited by Hot Filament Chemical Vapor Deposition (HF CVD) technique onto single-crystal (100) silicon wafer. It was shown that the Raman spectroscopy is a useful method to study diamond nucleation and growth process. It also allows to check diamond quality and identifies other carbon forms co-deposited during diamond growth process. The Raman spectroscopy *in situ* measurements give some ideas about diamond growth kinetics.

Алмазные пленки осаждались на плоскость (100) монокристаллической кремниевой пластины методом химического осаждения из паровой фазы с применением накаленной нити (HF CVD). Показано, что Раман-спектроскопия является полезным методом для исследования процессов зародышеобразования и роста алмаза. Он позволяет также контролировать качество алмаза и идентифицировать другие модификации углерода, совместно осаждающиеся в процессе роста алмаза. Измерения комбинационного рассеивания *in situ* дают некоторую информацию о кинетике роста алмаза.

Diamond, due its excellent properties such as extreme hardness, good thermal conductivity, chemical inertness and good optical transparency, is one of the most attractive materials for different applications [1].

Diamond individual crystals and continuous films were successfully deposited on non-diamond substrates [2] using various forms of the CVD technique from hydrocarbon-hydrogen mixtures. Diamond films are grown usually on heterogeneous materials (most frequently on silicon substrates) and are polycrystalline in nature. The substrate properties and surface are critical for diamond nucleation and subsequent growth of the continuous layer. The nucleation density influences the diamond film crystalline properties and thus physical ones. Diamond growth process by CVD technique can be subdivided into initial nucleation stage and subsequent continuous layer growth one. The nucleation density depends strongly on the substrate surface characteristics and can be effectively enhanced by the surface pretreatment. Usually, the substrate surface is mechanically polished with fine-grain diamond paste, but plasma etching and ion implantation can be also used in order to create surface defects where diamond nucleation takes place [3, 4]. In this work, we report the preparation and characterization of diamond film using Raman spectroscopy measurements on different stages of the diamond growth process.

The Raman spectrum is a characteristic signature that identifies different forms of carbon [5]. Diamond is characterized by single sharp line at 1332.5 cm^{-1} which allows to recognize diamond against other types of carbon. The shift of the diamond line position is related to the stress state in deposited layer while the line width relates to the diamond quality i.e. to the structural order. The defects and impurities cause the short-