

직류 바이어스를 이용한 나노결정 실리콘의 구조 및 광학적 특성

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Characterization of hydrogenated nanocrystalline silicon thin films prepared with various negative DC biases

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Abstract : Hydrogenated nanocrystalline Si (nc-Si:H) thin films were prepared by plasma enhanced chemical vapor deposition (PECVD). The films were deposited with a radio frequency power of 100 W, while substrates were exposed to direct current (DC) biases in the range from 0 to -400 V. The effects of the DC bias on the formation of nanoscale Si crystallites in the films and on their optical characteristics were investigated. The size of the Si crystallites in the films ranges from ~ 1.9 to ~ 4.1 nm. The relative fraction of the crystallites in the films reached up ~ 56.5 % when the DC bias of -400 V was applied. Based on the variation in the structural, chemical, and optical features of the films with DC bias voltages, a model for the formation of nanostructures of the nc-Si:H films prepared by PECVD was suggested. This model can be utilized to understand the evolution in the size and relative fraction of the nanocrystallites as well as the amorphous matrix in the nc-Si:H films.