

# Nonlinear stability analysis of the growth surface during diamond chemical vapor deposition

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The morphological stability of the solid–gas interface under conditions of diffusive transport of reactant species towards the surface during the chemical vapor deposition process is analyzed using linear and nonlinear perturbation theories. The Landau coefficient, which represents the nonlinear growth rate, is calculated using the direct method of undetermined coefficients. A dispersive relation is derived which relates the effects of species diffusive transport towards the growing interface, surface diffusion, and geometrical factors with the stability of perturbations on the interface. The resulting relation is applied to the diamond chemical vapor deposition process. Linear and nonlinear instability of the interface is obtained for diamond chemical vapor deposition conditions. Linear instability increases but the Landau coefficient becomes larger, indicating greater nonlinear stability as the reactor pressure increases, although both linear and nonlinear analyses suggest more stability as the reactor temperature increases. However, during typical diamond growth conditions, it is predicted that the diamond–gas interface is unstable to both infinitesimal and finite amplitude disturbances. © 1998 American Institute of Physics. [S0021-8979(98)07611-7]