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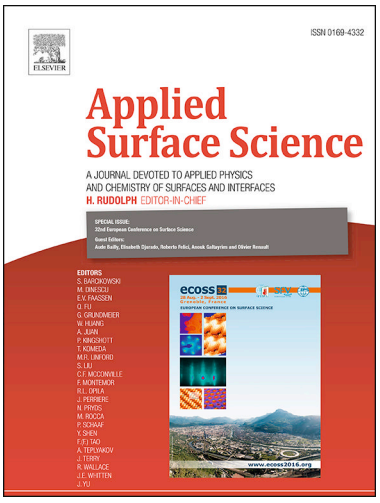

Full Length Article

Low-Temperature Amorphous Boron Nitride on $Si_{0.7}Ge_{0.3}$(001), Cu, and HOPG from Sequential Exposures of N_2H_4 and BCl_3

Steven Wolf, Mary Edmonds, Kasra Sardashti, Max Clemons, Jun Hong Park, Naomi Yoshida, Lin Dong, Srinivas Nemani, Ellie Yieh, Russell Holmes, Daniel Alvarez, Andrew Kummel

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Low-Temperature Amorphous Boron Nitride on $Si_{0.7}Ge_{0.3}$(001), Cu, and HOPG from Sequential Exposures of N_2H_4 and BCl_3

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ABSTRACT

Low-temperature sequential exposures of N_2H_4 and BCl_3 have been performed on $Si_{0.3}Ge_{0.7}$(001), Cu, and HOPG surfaces at 350°C. A novel BN ALD process has been achieved on $Si_{0.3}Ge_{0.7}$(001) with 60 cycles of BN ALD producing a uniform, pinhole-free thin film with low contamination, as characterized with XPS and AFM. On Cu and $Si_{0.3}Ge_{0.7}$(001), XPS spectra indicated a near stoichiometric BN film. While AFM imaging indicated the deposition on Cu yielded nanometer-scale etching, conformal deposition was observed on $Si_{0.3}Ge_{0.7}$(001). The BN ALD also nucleated on inert HOPG via step edges. *In situ* STM imaging showed that cyclic exposures at 350°C were able to decorate step edges with features ~2 nm tall and ~200 nm wide, indicating the propensity for BN to grow in the planar direction. The N_2H_4 and BCl_3 ALD allows for the deposition of low oxygen, low carbon films, but to avoid etching, the growth should be nucleated by N_2H_4, since exposure to BCl_3 can result in the formation of volatile Cl-containing surface species on many substrates. Therefore, the formation of a stable surface nitride prior to BCl_3 exposure is necessary to prevent formation and desorption of volatile species from the substrate.

Keywords: ALD, boron nitride, low temperature, etching