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Abstract

The structural, electronic, and nanomechanical properties of cubic niobium nitride thin films were investigated. The films were deposited on Si(100) under different background nitrogen gas pressures (26.7-66.7 Pa) at constant substrate temperature of 800 ^{o}C by reactive pulsed laser deposition. Our results reveal that the NbN_x films exhibit a cubic δ-NbN with strong (111) orientation and highly-oriented textured structures. We find nitrogen background pressure to be an important factor in determining the structure of the NbN_x films. The dependence of the electronic structure as well as that of the superconducting transition temperature (T_c) on the nitrogen gas background pressure is studied. A correlation between surface morphology, electronic and superconducting properties is found for the deposited NbN_x thin films. The highly-textured δ-NbN films have a T_c up to 15.07 K. Nanoindentation with continuous stiffness method is used to evaluate the hardness and modulus of the NbN_x thin films as a function of depth. The film deposited at nitrogen background pressure of 66.7