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New Phases of Boron Nitride Grown by Laser-Plasma Synchronous Chemical Vapor Deposition SHOJIRO KOMATSU, KAZUAKI KOBAYASHI, TAKAHIRO NAGATA, TOYOHIRO CHIKYO, National Institute for Materials Science, NIMS COLLABORATION — Dense sp3-bonded phases of boron nitride (BN) are known to grow under extremely high-pressure and high-temperature conditions like diamond is. However, we found that they grew at low pressures around 10 Torr and temperatures below 800° by plasma-assisted chemical vapor deposition where a pulsed excimer-laser at 193nm irradiating on the growing film surface induced highly nonequillibirum conditions. New polytypic forms of sp3-bonded BN, i.e., 5H-, 6H-, and 30H-BN were found and their crystal structures were discussed in terms of metastability, ionicity, hexagonality, and close-packing index. Based on the detailed analyses of the polytypic strtuctures of BN in comparison with C, SiC and AlN, we propose the "Bond Strength Initiative Rule", which helps to explain the growth of nonequillibrium phases from the vapor.

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