Electronic Supplementary Information

Enhanced Strength of Nano-polycrystalline Diamond by Introducing Boron Carbide Interlayers at the Grain Boundaries

Bo Zhao,[a] Shengya Zhang,[a] Shuai Duan,[a] Jingyan Song,[a] Xiangjun Li,[a] Bingchao Yang,*,[a] Xin Chen,[a] Chao Wang,[a] Wencai Yi,[a] Zhixiu Wang,[b] and Xiaobing Liu*,[a]

[a]Laboratory of High Pressure Physics and Material Science, School of Physics and Physical Engineering, Qufu Normal University, Qufu, Shandong Province, 273165, China

[b]Administrative Office of Laboratory and Equipment, Qufu Normal University, Qufu, Shandong Province, 273165, China

* To whom correspondence should be addressed. Email: xiaobing.phy@qfnu.edu.cn (X. Liu) or yangbc@qfnu.edu.cn (B. Yang).

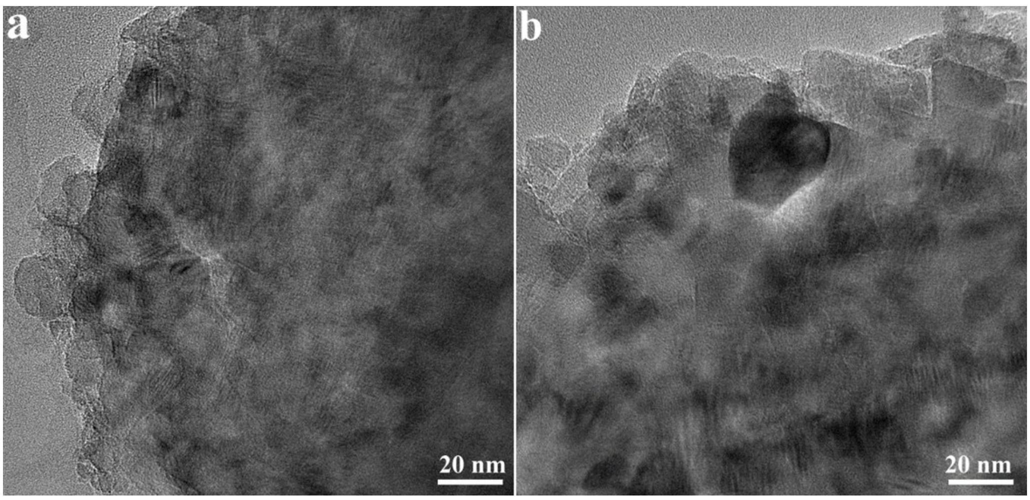

Fig. S1 TEM images of origin diamond powders reflect the grains were about 12-20 nm in size. The powders were obtained by explosion, which caused the uneven particle size.

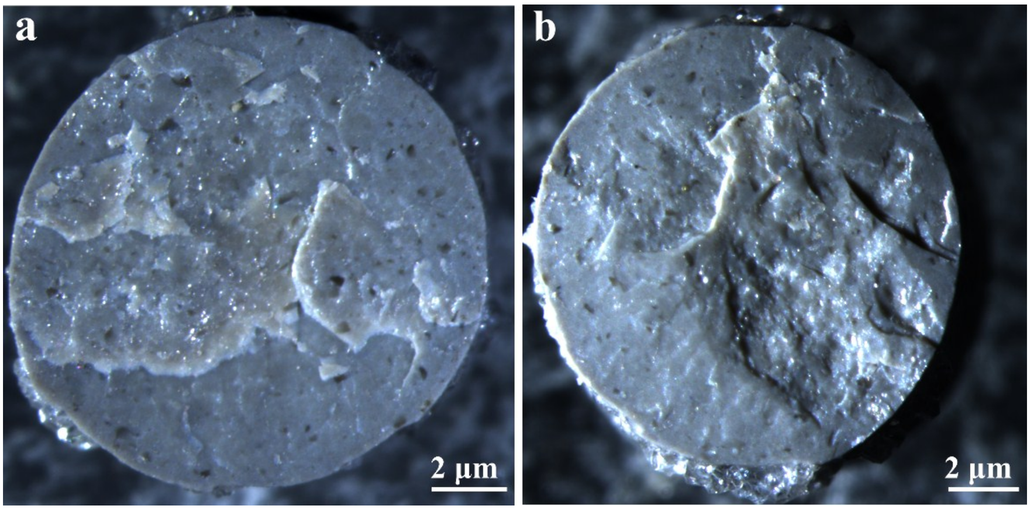

Fig. S2 Optical photograph of polycrystalline samples.

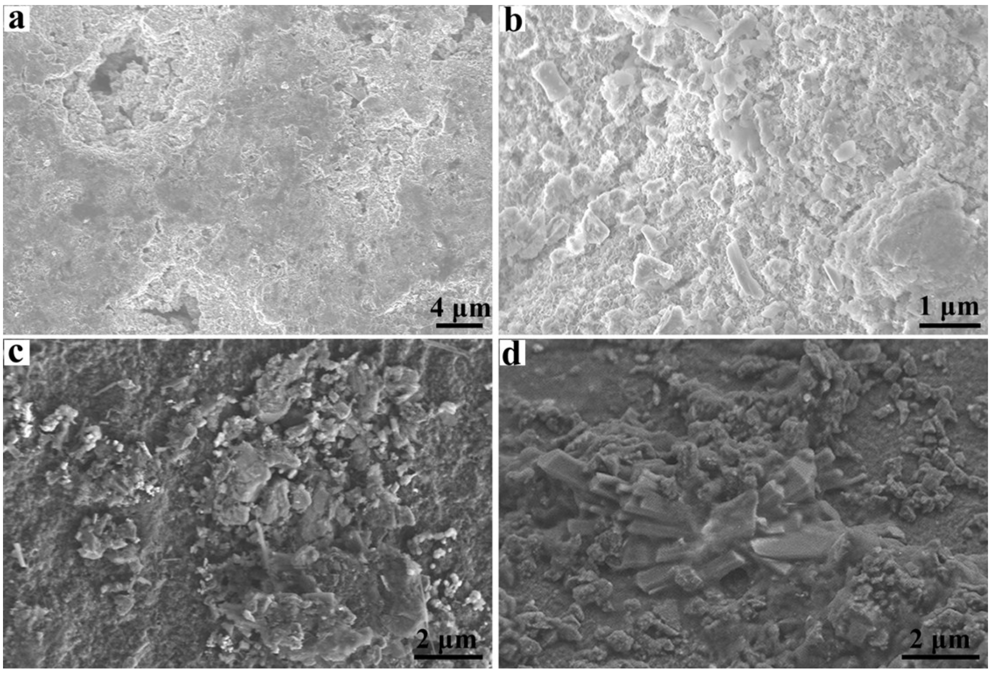

Fig. S3 SEM pictures of the sintered diamond (a-b), lower pressure samples from np-diamond with 3 wt.% B_4C (c) and 5 wt.%B_4C doped (d). These samples do not contain crystals that have grown to the micron scale with distinct boundaries.

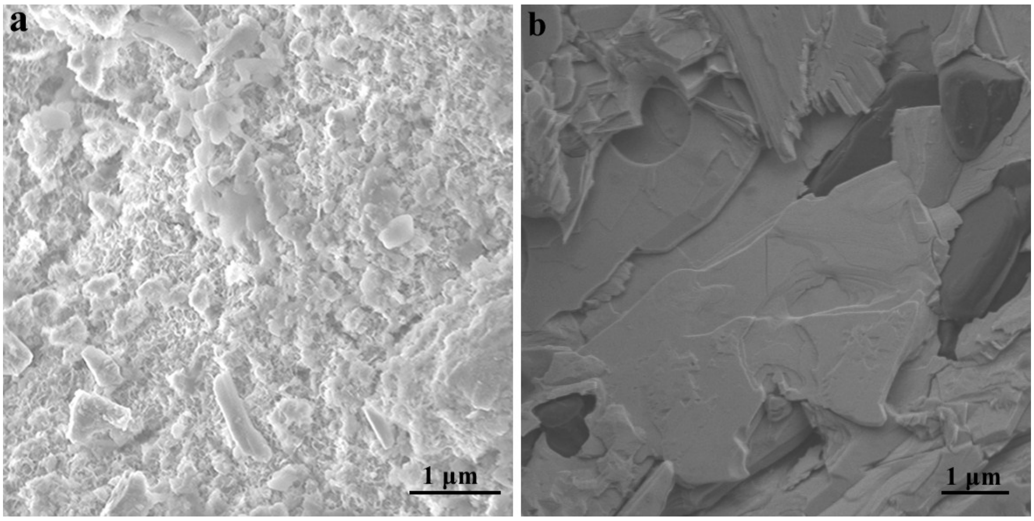

Fig. S4 The comparison of microstructure between sintered pure polycrystalline diamond and diamond/B_4C composite.

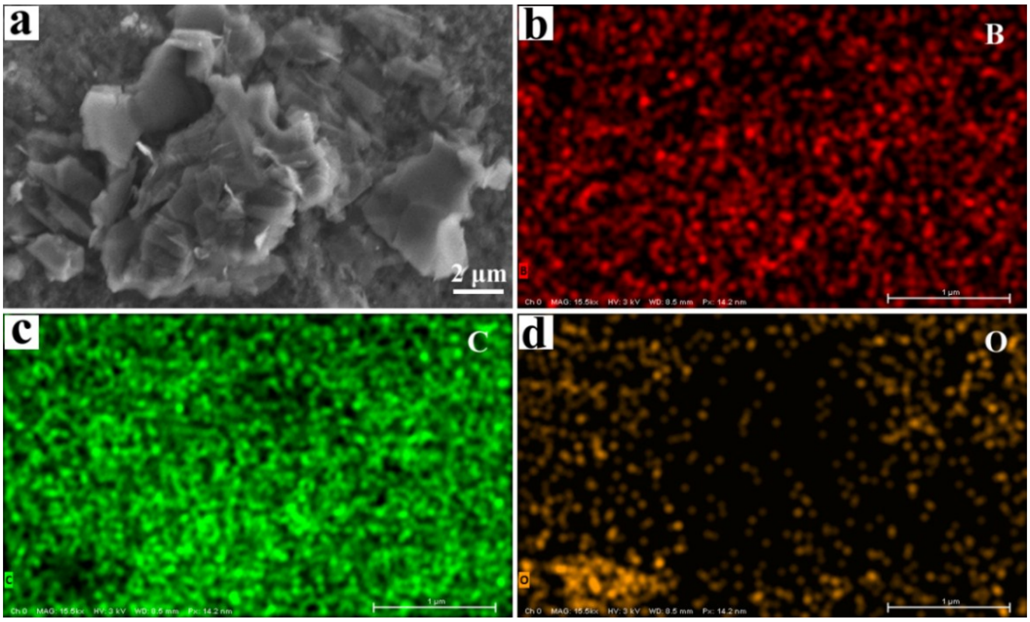

Fig. S5 Mapping results of sample from np-diamond with 3 wt.% B_4C additive. The crystals (a) were selected to accomplish the test. The distribution of B (b), C (c), O (d) elements shows same results with high pressure samples, which proves that the B_4C are uniformly distributed over the entire area of the grain.

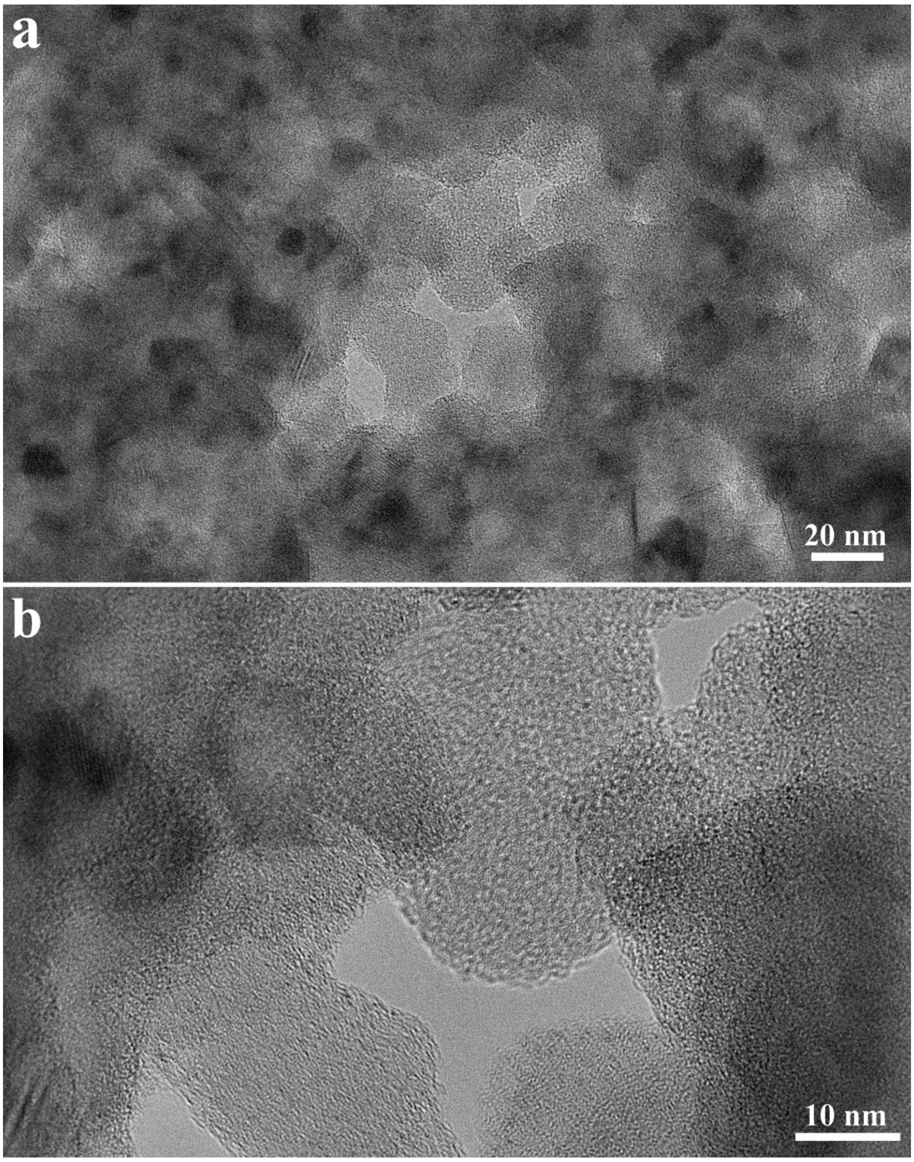

Fig. S6 HRTEM images of grains in polycrystalline diamond/B_4C composite.

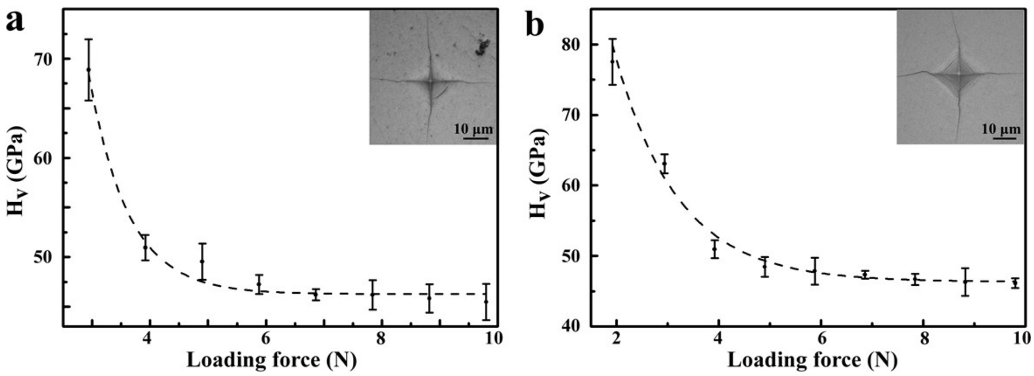

Fig. S7 Hardness of samples with 3 wt.% B_4C (a) and 5 wt.% B_4C (b) additive at lower pressure**.** The obvious cracks and clear indentations created at 9.8 N were exhibited in the top insets.

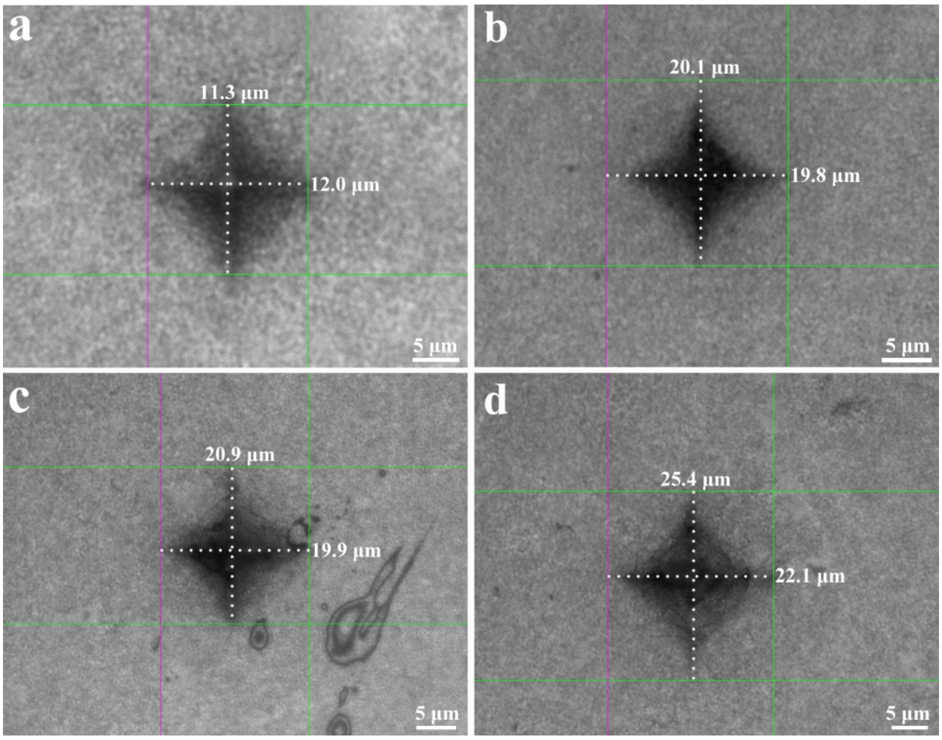

Fig. S8 Images show the cracks measurements of our np-diamond with 5 wt.% B_4C doped, which were created by 4.9 (a), 7.84 (b), 8.82 (c), 9.8 N (d) loads during hardness measurements. The cracks were marked by white dotted lines.