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Two dimensional boron nitride nanosheets produced by supercritical carbon dioxide exfoliation

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Boron nitride nanosheets (BNNS), also known as "white graphene", hold the similar two dimensional structure as graphene and unique properties complementary to graphene, which makes it attractive in applications ranging from electronics to energy storage. The large-scale exfoliation of boron nitride (BN) still remains a challenge and hinders the applications of BNNS. Here, we apply supercritical carbon dioxide to exfoliate boron nitride layers. Supercritical carbon dioxide intercalates and diffuses between boron nitride layers. Then, the fluid expands rapidly, overcomes the van der Waals forces and exfoliates boron nitride layers in the depressurization process. Electron microscopy strongly suggests that the boron nitride is exfoliated into thin sheets. Atomic force microscope was applied to analyze the thicknesses distribution of the produced BNNS. The results indicate that the produced sample has an average thickness of 4-6 layers. It is demonstrated that the produced BNNS is more stable in organic solvents compared with the raw boron nitride. Moreover, we prepared BNNS/epoxy composites as thermal interface materials. The thermal conductivity of BNNS based composite is much higher than that of BN/epoxy. The large scale BNNS produced by super critical carbon dioxide show great potential as thermal interface materials for heat dissipation of high efficiency electronics.

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