Covalent Diamond–Graphite Bonding: Mechanism of Catalytic Transformation

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Abstract. Aberration-corrected transmission electron microscopy of the atomic structure of diamond-graphite interface after Ni-induced catalytic transformation reveals graphitic planes bound covalently to the diamond in upright orientation. The covalent attachment together with a significant volume expansion of graphite transformed from diamond give rise to uniaxial stress that is released through plastic deformation. We propose a comprehensive model explaining the Ni-mediated transformation of diamond to graphite, covalent bonding at the interface, as well as the mechanism of relaxation of uniaxial stress. We also explain the mechanism of electrical transport through the graphitized surface of diamond. The result may thus provide foundation for catalytically driven formation of graphene-diamond nanodevices.