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Creation and formation mechanism of new carbon phases constructed by amorphous carbon.[1] MINGGUANG YAO, WEN CUI, BINGBING LIU, State Key Laboratory of Superhard Materials, Jilin University — Our recent effort is focusing on the creation of new hard/superhard carbon phases constructed by disordered carbons or amorphous carbon clusters under high pressure. We showed that the pressure-induced amorphous hard carbon clusters from collapsed fullerenes can be used as building blocks (BBs) for constructing novel carbon structures. This new strategy has been verified by compressing a series of intercalated fullerides, predesigned by selecting various dopants with special features. We demonstrate that the boundaries of the amorphous BBs are mediated by intercalated dopants and several new superhard materials have been prepared. We also found that the dopant-mediated BBs can be arranged in either ordered or disordered structures, both of which can be hard enough to indent the diamond anvils. The hardening mechanisms of the new phases have also been discussed. For the glassy carbon (GC) constructed by disordered fullerene-like nanosized fragments, we also found that these disordered fragments can bond and the compressed GC transformed into a transparent superhard phase. Such pressure-induced transformation has been discovered to be driven by a novel mechanism (unpublished). By understanding the mechanisms we can clarify the controversial results on glassy carbon reported recently.

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