AMORPHOUS SEMICONDUCTING BORON-CARBON SOLID SOLUTIONS

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Boron carbide has been widely utilized in industry and military because of its low mass-density, super-high hardness, and good electric conductivity. Its excellent mechanical, optical, and thermoelectric properties can be enhanced by nanoengineering. Therefore, boron-carbon nanoscaled compounds play a key role as starting materials of the carbide-based advanced functional materials. Here semiconducting boron-carbon solid solutions, B\textsubscript{x}C (x = 1 - 10), were synthesized by a carbothermic method. Their amorphous structures were characterized by X-ray powder diffraction and electron diffraction. Electron energy loss spectroscopic imaging showed that boron and carbon elements distributed uniformly at nanoscale in the as-synthesized materials. UV-vis spectroscopic measurements indicated the solid solutions were semiconductors with a band gap of 2.3 - 3.9 eV, depending on the carbon/boron ratio. The band gap was larger than that of B\textsubscript{4}C (2.09 eV) and elemental boron (1.5 eV) while close to amorphous carbon (2.5 - 3.0 eV). The B\textsubscript{x}C solid solutions can absorb UV-visible light from 200 nm to 500 nm strongly, and were utilized as solar materials.

![XRD patterns](image1.png)  ![UV-vis spectra](image2.png)

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