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Shear Enhanced Dynamic Compaction of a Granular Ceramic[1] XIANGYU SUN[2], KT RAMESH[3], Johns Hopkins University, ARMY RESEARCH LAB COLLABORATION[4] — Dynamic flow of granular media is ubiquitous phenomenon in many scenarios, including earthquakes, asteroid impact and ballistic impact into ceramics. As a promising candidate for protection applications, boron carbide has drawn attention due to its high mechanical strength and low density. The granular flow of boron carbide particles under multi-axial stress states has a significant influence on ballistic performance. However, granular flow at such extreme conditions has not been well characterized. In the current study, an ESK commercial boron carbide powder with average particle size $0.7\mu m$ was compacted in a fixture and loaded at strain rates around $10^5 s^{-1}$ and pressures of several GPa, using the technique called pressure shear plate impact. Both normal and shear stress as well as strain rate histories were obtained. The granular boron carbide is observed to undergo large compaction with a clear shear enhanced compaction, suggesting a particle rearrangement mechanism. We also discuss granular material behavior and particle size evolution under these dynamic conditions.

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