

Abstract Submitted
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Functionally graded, nanocrystalline, multiphase, B- and C-based superhard coatings CHARLES BLATCHLEY, Pittsburg State University, KS 66762, FEREDDOON NAMAVAR, University of Nebraska Medical Center, Omaha, NE 68198, ERIC TOBIN¹, JOHN ADAMS, Spire Corporation, Bedford, MA 01730, MICHAEL GRAHAM, Northwestern University, Evanston, IL 60208 — Candidate ceramic coatings for bearing applications must meet several criteria, such as hardness, to limit abrasive damage. Adhesion is essential to prevent destructive three-body wear. Toughness helps avoid brittle fracture and coating failure. Finally, temperatures during deposition must not damage the substrate. We report fabrication and testing of functionally-graded, nanocrystalline, multiphase Ti/BN coatings by ion beam assisted deposition (IBAD), with these properties. Hardness was measured > 42 GPa. Structural grading transitions from metallic to covalent bonding through the film, controlling constituents (TiN, TiB₂, B₄C, BN) to optimize adhesion, internal stress, hardness, and wear resistance. Pin-on-disk wear testing for 5 million cycles at 1 GPa contact stress, showed no wear, to potentially extend lifetimes by orders of magnitude in industrial or biomedical applications.

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