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Surface modification of a TiN coated steel by ion beam dynamic mixing

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The surface modification of a TiN coated steel was conducted by ion beam dynamic mixing (IBDM) with an ion energy of 70 keV and boron vapor deposition in order to investigate the mixing phenomena and to produce a mixed layer consisting of boron, titanium and nitrogen. The modified surface prepared at a boron/ion arrival ratio less than 2.2 has a convex-concave shape having a striped habit. It has been suggested that the striped convex-concave shape was developed by the “shadow effect” for the boron deposition and by the energetic ion irradiation to a initial irregularity, which may be initiated by the boron atoms acting as seeds or impurities. The mixed layer having a flat surface was not obtained except the surface layer having flat but boron-rich composition at greater boron/ion arrival ratios. From the point, where the modified layer is utilized for the under layer of the c-BN, it has been demonstrated that the roughened surface having periodically a 220 nm depth and a 200 nm separation, which may improve the adhesion of cBN thin films by the anchor effect, is produced. It has also been suggested that the boron-rich layer produced at the high boron/ion arrival ratio by IBDM possibly works well as that produced by an ion plating.

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