Effect of laser micro texturing on the performance of a polycrystalline boron nitride cutting tool for hard-part turning.

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Polycrystalline boron nitride cutting tools are widely used for hard-part steel turning due to their high wear resistance and long durability, however the issue of adhesion of workpiece to the cutting tool significantly affects the cutting tool lifetime. Using a nanosecond fibre laser surface texturing of a polycrystalline boron nitride single point cutting tool is proposed to improve its wear properties and extend tool life in turning of continuous AISI L2 hardened steel components. The textures, with topographical features' depths and pitch ranging from tens of nanometers to tens of micrometers, were first milled using a fibre laser (1064-nm wavelength) at different fluences, feed speeds and pulse durations, and finally characterised using a combination of optical microscopy and an Alicona 3D high resolution optical microscopy. The effect of different textures on the wear properties was investigated in turning tests under dry conditions and compared to a benchmark cutting tool made of the same material. The tests were stopped every 6 passes and the wear analysed. The online monitoring and post-processing of the cutting forces and the microscopical characterisation of the tested cutting tools allowed the evaluation of the effects of texture design on the wear progression. For textures depths in the order of 1.7 µm and post process roughness in the order of tens of nanometers, a reduction of cutting force and a decreased flank wear were achieved in dry turning.