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Study of plasma filtered DLC films and the influence on their tribological behaviour

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A high wear resistance and a low coefficient of friction are dominant characteristics for tribological coatings. DLC films proofed to be an excellent answer to these demands. Especially tetrahedral amorphous bonded carbon films (ta-C) show an outstanding performance even under dry and mixed lubrication conditions. The distinguished qualities of ta-C-films together with an industrial-suited deposition system are a promising combination for the increasingly demanding development of friction reducing and wear protective coatings. Up to now an efficient, industrial-suited ta-C production is only possible by arc-evaporation processes. Nevertheless, due to the unavoidable particle emission during the arc process, ta-C coatings have a high surface roughness and can often not be used without mechanical smoothening. Therefore high efforts are required to develop plasma filter techniques. Recently, an industrial-suited deposition system for ta-C films, basing on laser-assisted arc combined with a plasma filtering unit, has been developed.
This work presents the first results of those plasma filtered ta-C films. The focus has been on the properties of the filtered films e.g. roughness, adhesion and Young´s modulus as well as on the tribological performance. The effect of the plasma filter technique with respect to the film topography has been demonstrated. Filtered films with diversified thickness up to 4 microns were investigated. The tribotesting has been realised with an oscillating ball- on- disc- test under lubricated conditions. The running in behaviour as well as the friction progression of the filtered films have been reviewed. After the tribotesting, the evaluation of the wear scar and the calotte delivers information of wear. Also the effects of the filtered ta-C-films in regard to their performance under superlubricity conditions ($\mu<0.02$) have been studied. All results are compared and discussed to unfiltered mechanically polished ta-C films.

Keywords
DLC
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wear