PO4080

Process characterization of the Laser- Arc- technology for thick ta-C- coatings in an industrial batch system

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The vacuum arc evaporation technique stands out due to a very high degree of ionisation of the carbon species and increased ion energy necessary for deposition of dense tetrahedral amorphous diamond-like carbon (ta-C) films. Applying this technology super hard coatings with excellent low-friction properties can be deposited. The so-called laser arc modules LAM 400, 500 and 850 have been developed for the production of these films under industrial conditions. These arc evaporator systems use a Nd-YAG laser to trigger the arc discharge on a rotating cylindrical carbon target.
Besides the emission of macro particles, another disadvantage of the vacuum arc evaporation process is the high energy impact on substrates in respect of unwanted substrate heating. While the amount of macro particles embedded in thin films can be reduced by using special particle filter systems, the latter issue limits the hardness (sp3-content) of the coating. In the application of very thick ta-C coatings under industrial high rate deposition conditions the laser arc parameters like pulse arc current and pulse frequency were changed from 800 A to 1600 A and 300 Hz to 600 Hz, respectively. It will be shown, how these parameters determine the substrate heating and, hence, the sp3- content in the ta-C coatings.
The film properties of ta-C coatings on real components and the dependence from deposition parameters under industrial deposition conditions are shown and discussed.

Keywords
dlc
ta-C
pvd
plasma source