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Hydrogenated carbon layer system for sensory applications

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The thin film layer system, presented in this abstract, combines an excellent tribological behaviour with sensory qualities. The main part of the layer system is the hydrogenated carbon layer, one member of the carbon based coatings, deposited in a PECVD process. The hardness of the layer is in the range of 20 GPa and the coefficient of friction is about 0.2. The tribological properties of this layer are comparable to the well known DLC (diamond like carbon) layer. It also shows a well detectable piezoresistive characteristic. Under pressure the layer changes its resistance. This offers the possibility of integrating this sensory layer in high load regions for the detection of pressure and load distributions.
For the local detection of load a thin film layer system is investigated, which exists of a homogeneous hydrogenated carbon layer in a thickness of 6 µm, in direct contact chromium electrode structures are deposited in a PVD process. They are mainly fabricated in a lift off process. The chromium structures, with a thickness in the range of 100-200 nm, have to be protected by an electrical insulating and wear protecting layer. This top coating is deposited homogeneously in a thickness of 3 µm in a PECVD process. It is also a hydrogenated carbon layer, doped with silicon and oxygen.
This thin film layer system can be integrated in a washer system as a security and measurement system for screw joints.
It can also be directly deposited in the track of bearing rings of the detection of the load distributions in bearings.
Another application of this sensory layer system is as a monitoring system in forming processes, like cutting or deep drawing. For the detection of the cutting force a steel substrate with the piezoresistive layer system gets in direct contact with the stamp. This is important, because wear or adhesion on the cutting edge of the stamp causes an increase of load with the number of forming processes. The sensory system shall prevent a loss of quality of the punched component.
In the deep drawing process cracks and wrinkles shall be prevented by the integration of modules with the thin film layer on top. The sensory module can be easily integrated in the drawing cushion of a deep drawing machine. During the forming process the steel plate is in direct touch with the sensor system and moves over it. The position of the plate is measured in dependence on the forming stadium.

Keywords
DLC
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