Protective coatings for extrusion of glass fiber reinforced plastics

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The extrusion of plastics is a growing market. Glass fiber reinforced plastics (GFRP) are increasingly used for components that require better mechanical stability and distortion resistance. Due to the incorporation of relatively hard fibers such as glass or carbon fibers the wear of the extrusion tools increases dramatically. It has been observed that the wear increases with the amount of glass fiber added to the GFRP material. Also, the geometry of the glass fibers plays an important role in the mechanical stability of the resulting component: The longer the glass fiber parts, the higher the mechanical stability (especially low distortion) of the GFRP-components. However, longer glass fibers also increase the wear rate of the tool and hence reduce the tool life. A shorter tool life means that more service time is required to replace the tools which leads to increasing production costs. Therefore, hard and wear resistant coatings are applied to extrusion tools in order to extend their life time. Depending on the specific wear mechanisms such as abrasion, adhesion or tribochemical attack the mechanical and chemical properties of the hard coatings have to be adapted for the specific composition of the GFRP-material such as the polymer matrix material, the kind of glass fibers, and other chemical additives. While the glass fibers mainly induce abrasive wear, polymers of the plastic materials could also generate tribochemical attack. And the combination of the two could lead to specific wear mechanisms for the different GFRP-materials. The coating has to meet these special requirements. For the specific combination of glass fiber reinforced PVC a test setup was developed to compare the wear behavior of the different coatings. Tools that were used in the industrial production were analyzed to adapt the test setup to the real conditions and to investigate the wear mechanisms. Several coatings were tested and compared with each other. The investigation started with reference PVD-CrN-coatings that are typically used for such applications. The coatings were produced by magnetron sputtering as well as cathodic arc deposition.

Keywords
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extrusion of GFRP materials