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Wear and fatigue resistant tool coatings for metal forming applications

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Engineering parts made out of high-strength-steel (HSS) sheets are widely used in the structural reinforcement of the car bodies especially where a high impact and crash resistance is required (e.g., passenger compartment, parts of side doors and bumpers). The increasing need for HSS parts in a typical car body (~40% in 2007 to 75% in 2015) on the one hand and development of sophisticated steel grades with very high strengths (>1000 MPa in UHSS) on the other hand demand the utilization of coatings which in combination with state-of-the-art surface treatments (eg nitriding) provide considerable resistance against a variety of failure mechanisms like adhesive and abrasive wear, galling, chipping, and spallation under severe forming loads. Nitride based coatings like TiN, TiAlN, TiCrN, and AlCrN, which are also used in cutting tool applications have significantly increased the performance of these forming tool applications when compared to non-coated ones. But as the specific requirements in terms of resistance to abrasive and adhesive wear, fatigue, and in some cases corrosion are completely different for metal forming applications, there is an increasing demand for dedicated and in many cases complex coatings. The present work addresses the development of the wear and fatigue resistant coatings made by physical vapor deposition (PVD) technique to be used for high-scale industrial forming applications of advanced high strength steel (AHSS) and high strength low alloy (HSLA) sheets. Examples of successful implementation of the coatings in some sophisticated industrial forming applications are presented.

Keywords

PVD

HSS

Metal forming