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3D conformal deposition of protective ceramic layers on complex tools and injection molds via chemical vapor deposition

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Chemical vapor deposition (CVD) is a well-known process to produce high quality thin coatings, such as films with specific properties to protect metallic tools and injection molds from wear, corrosion, and others. However, it can be difficult to obtain a high-performance coating on complicated three-dimensional surfaces of some tools. It needs understanding of the formation of solid material from a gaseous phase, containing complex molecules of volatile matter; research of metalorganic precursors, which decompose at low temperatures (500 °C) and allow the deposition of conformal layers into narrow cracks and holes; and the detailed research of the 3D substrate materials to clarify the influence of the steel alloy on the adhesion of the layers. The aim of this study is the deposition of CVD layers for three-dimensional zirconia coatings on metallic tools and injection molds. At the present stage of the research the way of deposition and characterization of the coatings on 3D surfaces is developed. The experimental parameters for successful deposition of zirconia layers with various dopants are found and tribological properties of substrate and thin film materials are investigated.

Keywords

Chemical vapor deposition
protective coatings
injection molds
tribological properties
zirconia