

Plastic Flow and Related Wear Mechanisms of CVD TiC Coatings

簡錫新, 馬廣仁, 葉雲鵬, 阿偉, 郭建煌, 趙崇禮

Mechanical Engineering

Engineering

ma600229@ms17.hinet.net

Abstract

Ceramic coatings have been widely used in cutting tools and various machine parts. Even though high strengths have been obtained in most ceramic coatings, it has also been shown that ceramic coatings undergo extensive plastic deformation during scratch and wear tests. Therefore, it is essential to understand the plastic flow and related friction and wear behaviour. Reciprocating multipass wear tests have been carried out on chemical vapor deposition (CVD) TiC coatings. Obvious plastic flow was observed on the rough surface of CVD TiC ceramic coatings in the first sliding, due to the extremely high contact pressure developed on the contact asperities. However, shake down may be quickly reached after several subsequent traverses. In further repeated traverses, the plastic-elastic flow accumulates residual strain energy to the point where cracking, microbuckling, and microflaking may occur along the elastic-plastic interfaces behind the indenter. The new rough surface will appear after the detachment of the heavily strained plate-like wear debris. The repeated sliding allows the process- “plastic flow of asperities - flatten the surface and shake down - microbuckling and detachment of strained layer” to continue until the coating is totally worn out.

Keyword : CVD, TiC coatings, plastic flow, wear, microflaking