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## Internal stress on adhesion of hard coatings synthesized by multi-arc ion plating

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The performance of PVD hard coatings is strongly affected by the level of residual stress as it may cause the coatings to detach from the substrate and thus shorten the tool's life. In this study, the residual stress on adhesion of hard coating synthesized by multi-arc ion plating (MAIP) has been investigated. The results indicate that the residual stress of hard coatings has a strong dependence on processing conditions, which is shown by increasing bias voltage and/or decreasing working pressure. Low critical load is assessed for thick coating indicating high interfacial stress, yet the average residual stress obtained from substrate curvature is decreased with increasing thickness. By using finite element modeling (FEM), it is found that high compressive residual stress induces large shear stress at the coating/substrate interface. This implies that the accumulated compressive residual stress is more appropriate than the average one in characterizing the effect of residual stress on coating's adhesion strength. In addition, the effects of residual stress on coating's bonding strength are clearly revealed by using cyclic spherical indentation (CSI) test.

*Keywords:* Hard coatings; residual stress; adhesion;

**1. Introduction**

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