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The Elasto-Plastic Thin Film/Substrate Via Buckle-Driven Delamination and Crack Growth

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Indentation test is becoming increasingly used to quantitatively assess the thin film interfacial adhesion for its simplicity and ability to mechanically probe the smallest of solids. The conventional technique is based on the analysis of Marshall and Evans (1984) which is a combination of Linear Elastic Fracture Mechanics (LEFM) and simplified post-buckling theory. In this paper a full post-buckling response of elasto-plastic thin film is investigated by FEM calculation; the contributions of double-buckling and plastic buckling to the indentation test is discussed. The results show that double-buckling needs more energy than single-buckling case thus lead to a greater value of strain energy release rate; and plasticity is a significant factor for those films with low yield stress and must be taken in account in adhesion measurement.

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