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# A Review of Theoretical Analysis Techniques for Cracking and Corrosive Degradation of Film-Substrate Systems

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## Abstract

This paper contains a review of the most vital concepts regarding the analysis and design of film systems. Various techniques have been presented to analyse and predict the failure of films for all common types of failure: fracture, delamination, general yield, cathodic blistering, erosive and corrosive wear in both organic and inorganic films. Interfacial fracture or delamination is the loss of bonding strength of film from substrate, and is normally analysed based on the fracture mechanics concepts of bi-material systems. Therefore, keeping the focus of this review on bonding strength, the emphasis will be on the interfacial cracking of films and the corresponding stresses responsible for driving the delamination process. The bi-material characteristics of film systems make the nature of interfacial cracks as mixed mode, with cracks exhibiting various complex patterns such as telephone cord blisters. Such interfacial fracture phenomenon has been widely studied by using fracture mechanics based applicable analysis to model and predict the fracture strength of interface in film systems. The incorporation of interfacial fracture mechanics concepts with the thermodynamics/diffusion concepts further leads to the development of corrosive degradation theories of film systems such as cathodic blistering. This review presents the suggestions for improvements in existing analysis techniques to overcome some of the limitations in film failure modelling. This comprehensive review will help researchers, scientists, and academics to understand, develop and improve the existing models and methods of film-substrate systems.

**Keywords:** Film Failure; Film cracking; Interfacial cracking; Corrosion; Cathodic delamination; Cathodic blistering; Tribo-corrosion

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