



# The Mechanics and Reliability of Films, Multilayers and Coatings

By Matthew R. Begley, John W. Hutchinson

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A wide variety of applications ranging from microelectronics to turbines for propulsion and power generation rely on films, coatings, and multilayers to improve performance. As such, the ability to predict coating failure - such as delamination (debonding), mud-cracking, blistering, crack kinking, and the like - is critical to component design and development. This work compiles and organizes decades of research that established the theoretical foundation for predicting such failure mechanisms, and clearly outlines the methodology needed to predict performance. Detailed coverage of cracking in multilayers is provided, with an emphasis on the role of differences in thermoelastic properties between the layers. The comprehensive theoretical foundation of the book is complemented by easy-to-use analysis codes designed to empower novices with the tools needed to simulate cracking; these codes enable not only precise quantitative reproduction of results presented graphically in the literature, but also the generation of new results for more complex multilayered systems.

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### **Editorial Review**

#### **About the Author**

Professor Matthew R. Begley is recognized for seminal contributions in the mechanics of multilayered systems, with an emphasis on computational aspects of the required analysis. His codes are employed in some industries to design experiments, assess current designs and evaluate novel multilayer systems for improved performance. He is widely sought after for consulting work on the mechanics of thin films, coatings and multilayers, by companies such as General Electric, Pratt and Whitney, Intel, Sunpower, Raytheon and Areva.

Professor John W. Hutchinson is a member of the US National Academies of Engineering and Sciences and a Foreign Member of the Royal Society of London. He is one of the leading experts in the mechanics of thin film systems, with a number of highly cited, seminal journal papers on the subject. Hutchinson is credited with generating many of the conceptual developments in this field, as well as illustrations of those concepts to applications such as microelectronics, thermal barrier coatings, microfluidic devices and hypersonics.

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