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3 Constitutive and User-Supplied Subroutines for Solders Considering Damage Evolution3.1 Constitutive Model for Tin-Lead Solder Joint; 3.1.1 Model Formulation; 3.1.2 Determination of Material Constants; 3.1.3 Model Prediction; 3.2 Visco-Elastic-Plastic Properties and Constitutive Modeling of Underfills; 3.2.1 Constitutive Modeling of Underfills; 3.2.2 Identification of Material Constants; 3.2.3 Model Verification and Prediction; 3.3 A Damage Coupling Framework of Unified Viscoplasticity for the Fatigue of Solder Alloys; 3.3.1 Damage Coupling Thermodynamic Framework
3.3.2 Large Deformation Formulation3.3.3 Identification of the Material Parameters; 3.3.4 Creep Damage; 3.4 User-Supplied Subroutines for Solders Considering Damage Evolution; 3.4.1 Return-Mapping Algorithm and FEA Implementation; 3.4.2 Advanced Features of the Implementation; 3.4.3 Applications of the Methodology; 3.5 Chapter Summary; References; 4 Accelerated Fatigue Life Assessment Approaches for Solders in Packages; 4.1 Life Prediction Methodology; 4.1.1 Strain-Based Approach; 4.1.2 Energy-Based Approach; 4.1.3 Fracture Mechanics-Based Approach; 4.2 Accelerated Testing Methodology
4.2.1 Failure Modes via Accelerated Testing Bounds4.2.2 Isothermal Fatigue via Thermal Fatigue; 4.3 Constitutive Modeling Methodology; 4.3.1 Separated Modeling via Unified Modeling; 4.3.2 Viscoplasticity with Damage Evolution; 4.4 Solder Joint Reliability via FEA; 4.4.1 Life Prediction of Ford Joint Specimen; 4.4.2 Accelerated Testing: Insights from Life Prediction; 4.4.3 Fatigue Life Prediction of a PQFP Package; 4.5 Life Prediction of Flip-Chip Packages; 4.5.1 Fatigue Life Prediction with and without Underfill
4.5.2 Life Prediction of Flip-Chips without Underfill via Unified and Separated Constitutive Modeling

Sommario/riassunto

Although there is increasing need for modeling and simulation in the IC package design phase, most assembly processes and various reliability tests are still based on the time consuming ""test and try out"" method to obtain the best solution. Modeling and simulation can easily ensure virtual Design of Experiments (DoE) to achieve the optimal solution. This has greatly reduced the cost and production time, especially for new product development. Using modeling and simulation will become increasingly necessary for future advances in 3D package development. In this book, Liu and Liu allow people