

ACCELERATED DESTRUCTIVE DEGRADATION TEST PLANNING

by

**Ying Shi, Iowa State University, Luis Escobar, Louisiana State University,
William Q. Meeker, Iowa State University**

May, 2008

ABSTRACT

Accelerated Destructive Degradation Tests (ADDTs) provide reliability information quickly. An ADDT plan specifies factor level combinations of an accelerating variable (e.g., temperature) and evaluation time and the allocations of test units to these combinations. This paper describes methods to find good ADDT plans for an important class of destructive degradation models. First, a collection of optimum plans is derived. These plans minimize the large sample approximate variance of the maximum likelihood (ML) estimator of a specified failure-time quantile. The General Equivalence Theorem (GET) is used to verify the optimality of these plans. Because an optimum plan is not robust to the model specification and the planning information used in deriving the plan, a more robust and useful compromise plan is proposed. Sensitivity analyses show the effects that changes in sample size, time duration of the experiment, levels of the accelerating variable, and misspecification of the planning information have on the precision of the ML estimator of a quantile of the failure-time distribution. Monte Carlo simulations are used to evaluate the statistical characteristics of the ADDT plans. The methods are illustrated with an application for an adhesive bond.