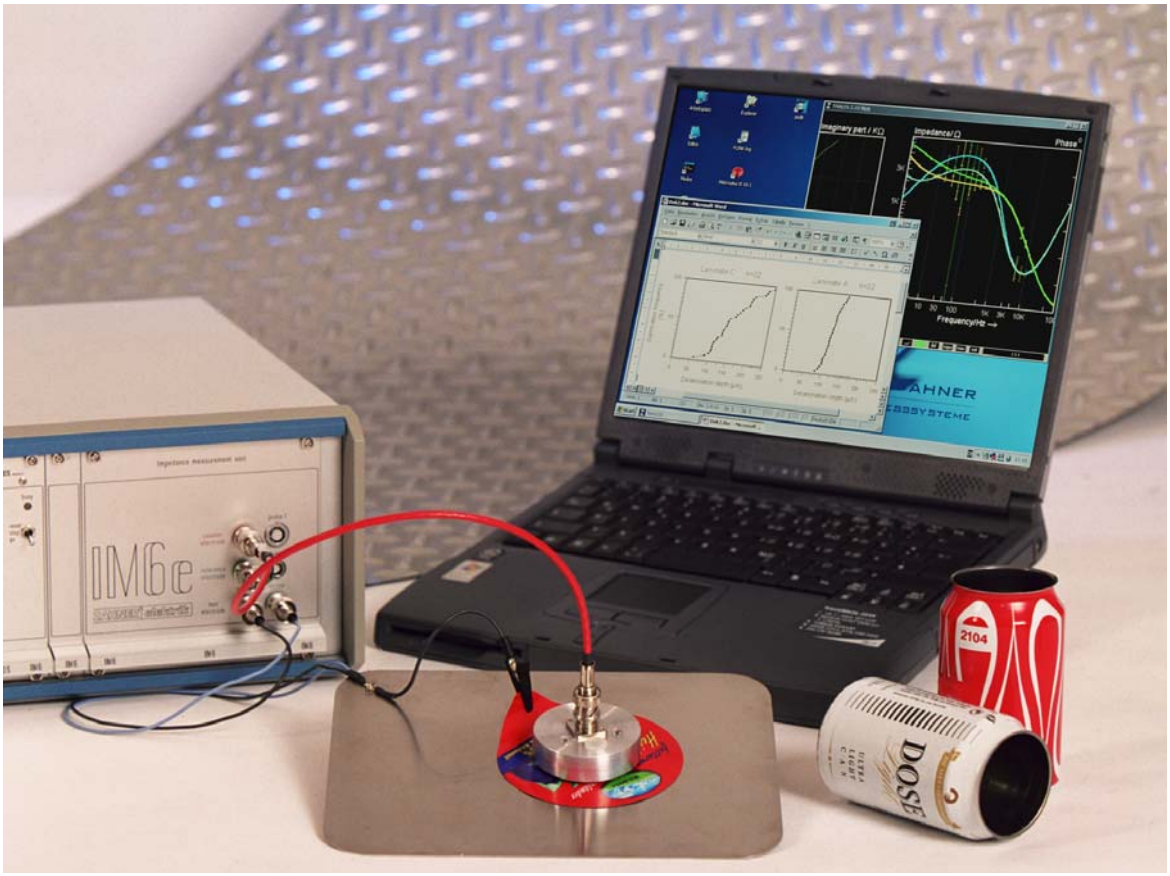
Coating & Laminate Tester

COLT

Complete System for the Testing of Coatings & Laminates

Test the quality and stability of coatings and laminates



with an easy-to-use electrochemical technique

ZAHNER®

Messsysteme

The Problem

Coated metal and metal composite materials have enormous significance worldwide as packaging materials. This means that the manufacturers of food packaging such as cans, foils and so forth face a serious risk: if a packaging system fails at the customer, claims for damages rising to millions can easily follow.

The weaknesses of foil and coating systems are known: The bond between the metal and the coating is often involved. Even during the course of manufacture, processing steps such as stretching, deep drawing, stamping, or printing create mechanical stress. The sterilisation process, and of course the corrosive effect of the contained materials during storage of the finished product, generate and expand cracks and pores in the protective coating, leading in the end to the feared

breakdown of the metal-polymer bond

i.e. to the delamination of the coating.

Breakdown of the polymer-metal bond is usually preceded by a local rise in the pH value. If electrolyte molecules from the stored materials penetrate through pores, at impurities, at damaged locations, or by means of diffusion as far as the phase boundary to the metal, dissolution of traces of metal will lead to a local rise in alkalinity. The polymer-metal bond weakened in this way potentially is subjected to further stress through the development of gaseous hydrogen.

Area delamination

heralds the final failure of the packaging system.

Electrochemical methods are, in general, suitable for determining the quality of packaging. Electrochemical Impedance Spectroscopy, EIS, in particular is a sensitive tool for the detection of pores and damaged locations, and for measuring the quality of lacquers and coatings.

Unfortunately, merely determining the quality level is not sufficient to provide a reliable prediction of failure cases. Even when EIS is used, it is only in combination with systematic stress or ageing trials that reliable predictions can be obtained.

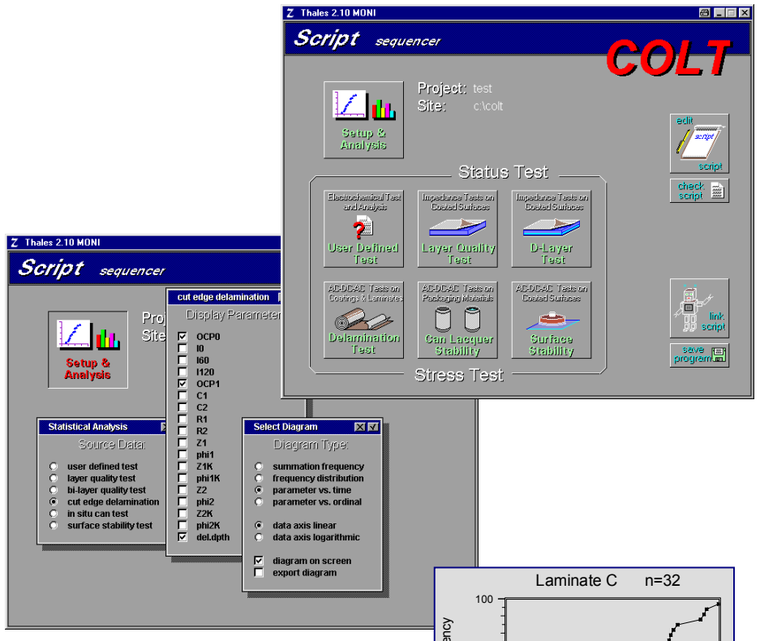
The Breakthrough

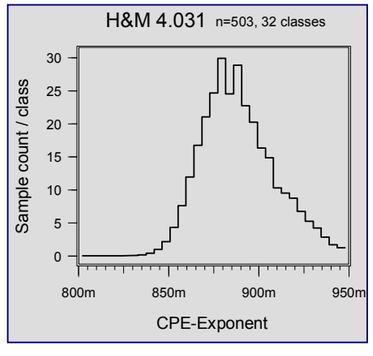
A successful strategy, therefore, consists of combining a general determination of the condition with phases of stress. It is in this way possible to trace the changes in general condition triggered by the effects of stress.

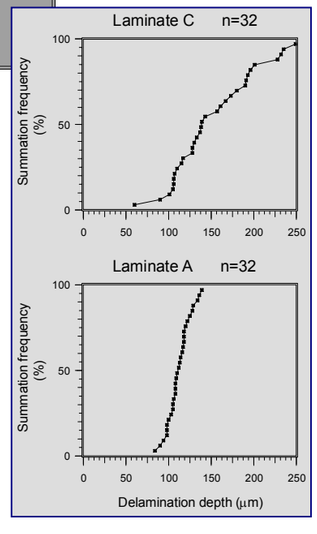
What methods are available to simulate realistically the stress placed on the packaging of the finished product under the influence of the contained material without expensive, time-consuming ageing tests?

The Solution

Accelerate the natural degradation of the packaging material through electrochemical stress !







Cathodic polarisation of the polymer-metal interface accelerates, by orders of magnitude, the natural process of

dissolution of metal traces
→ alkalisation
→ potential hydrogen formation
→ delamination

The unique advantage of using electrochemical stress, as against all other methods of accelerating degradation, is that the test object can remain in the same test equipment for the application of stress as is used to determine the condition of the coating.

The Time–Machine : AC–DC–AC

Determination of the condition by means of non-destructive EIS (AC method) requires an electrochemical workstation. Its integrated potentiostat also controls the electrochemical stress phase through cathodic polarisation (DC method). Determining the condition of the material following controlled stress is carried out once again by means of EIS (AC method). Precise analysis of the changes in condition between "before" and "after" provides the basis for reliable prediction.

The AC-DC-AC sequence gave this revolutionary test method its name.
AC-DC-AC was developed over recent years by Dr. Jochen Hollaender at the *Fraunhofer Institut für Verfahrenstechnik und Verpackung* in Freising, Bavaria, and has been perfected by Zahner as a reliable, automatic test method.

The COLT System

The IM6/6e Electrochemical Workstation is the heart of the COLT. The IM6 is renowned for its high precision, ease of use and comprehensive software package.

Its revolutionary **Script** software concept allows complex processes to be fully automated. The Script COLT controls the execution of AC measurement, DC polarisation with recovery phase and further AC measurement in strictly reproducible form. The reliable analysis of EIS measurements is not trivial. For this reason, COLT also carries out the comparative impedance analysis, reducing the data to well-defined, meaningful results, recording all the important parameters in a form suitable for statistical analysis, and the documentation of each individual measurement together with a printout or file export.

The Peripherals

A cleverly devised combination of measuring cells, electrodes and auxiliary equipment, specially constructed for COLT, reduces the time needed to prepare and connect samples, allowing a high throughput of test samples.

The Methods

AC-DC-AC tests

Cut Edge Delamination Test	Evaluates the delamination trend of coatings or laminates
In-Situ Can Test	Tests the stability of ready-made cans with test electrolyte or contained materials
Coating Stability Test	Discovers the degradation tendency of coated surfaces

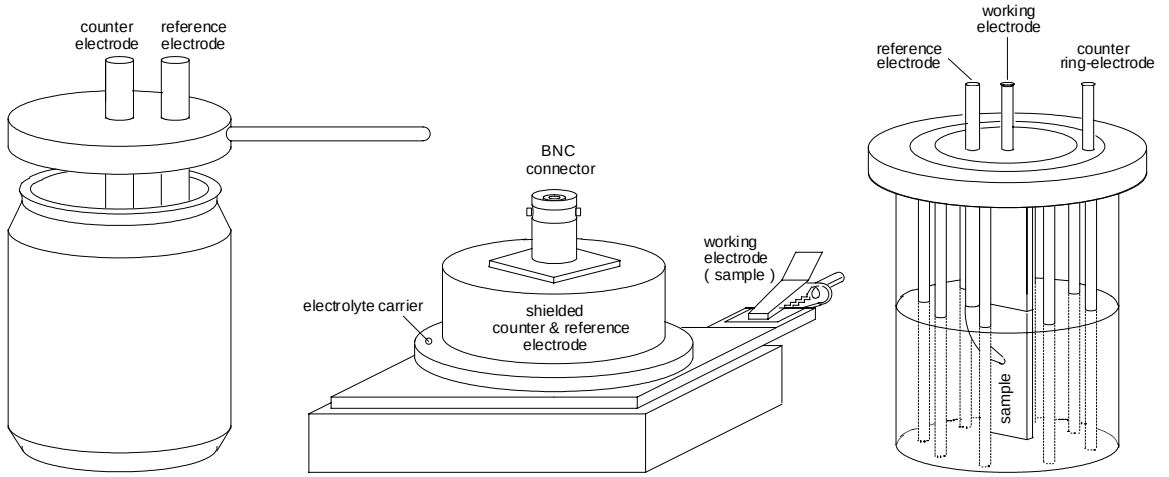
Non-destructive tests

Layer Quality Test	Evaluates the thickness, homogeneity, soaking tendency, and pores density of surface layers
Bi-Layer Test	*Layer Quality Test* for bi-layers such as adhesive + laminate

Optional tests

User defined test	Individual test procedures such as AC and DC methods

The Typical Measurement Setups



The COLT Kit Consists of

General	Coating Stability Test & Layer Quality Test	Cut Edge Delamination Test & In-Situ Can Test
IM6e Thales software + COLT module PC interface Cable sets Plastic tweezers and pipette	Shielded cylinder electrode Set of electrolyte carriers Buffer solutions	Glass vessel Stainless steel ring electrode Reference electrode Electrode stand Foil cutter

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