Bubble Formation on Electroplated Parts.

Finding Defect Causes after Climate Testing

May, 2012

The problem:

PC/ABS parts that were apparently well electroplated showed a distinct bubble formation in some areas after temperature cycling test (*Fig. 1*). Because of that, the entire production batch had to be stopped.

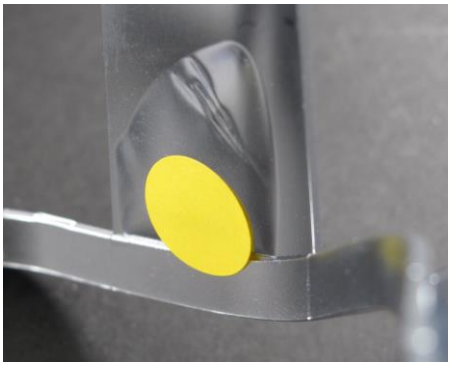

Fig. 1: Electroplated part with bubble formation.

The solution:

A typical bubble was opened at the Analytik Service Obernburg. The polymer surface below the bubble appears to be darker than on the freshly pulled-off reference zone (red arrow in *Fig. 2*). In the bubble area, there is only little polymer adhesion on the metal. Its adhesion in the reference zone, however, is so high that a part of the polymer was teared-off during pulling-off the metal layer – the underside of the metal is covered by numerous polymer deposits (*Fig. 3*). In a subsequent step, the polymer in the reference zone was chemically removed so that the metal underside was uncovered (*Figs. 4 and 5*); here, a cavern structure in varying degree can be seen.

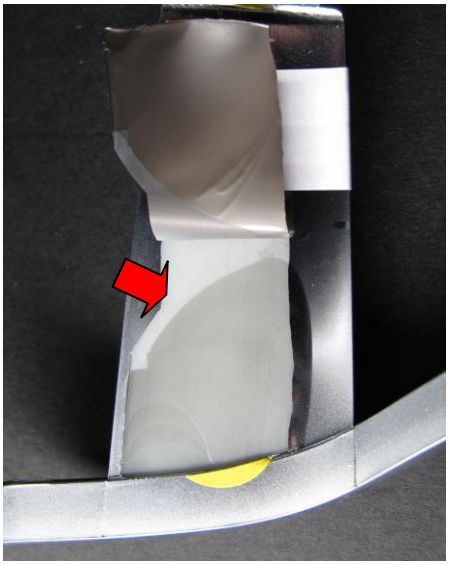

Fig. 2: Opened bubble

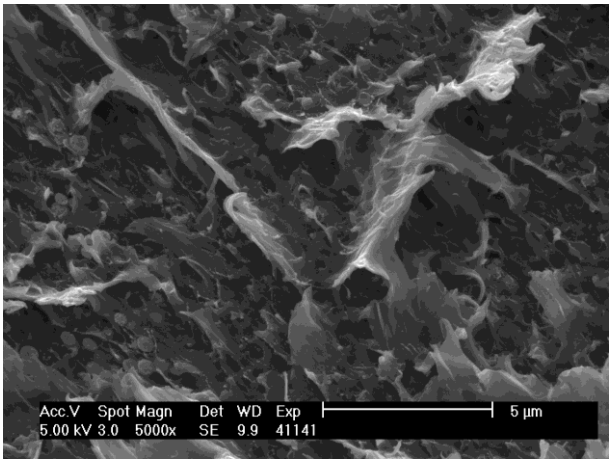

Fig. 3: Metal underside of the reference zone with polymer deposits.

Industries (A-Z)
Automotive
Electroplating
Medical Technology
Plastics Processing

Objectives
Failure Analysis
Process Optimization

Materials
Electroplated Plastics

Analytical Method
Scanning Electron Microscopy

Supplementing Methods (A-Z)
Climate Testing
FTIR Spectroscopy
Optical Microscopy
Testing of Initial Samples

Related Topics
Defect Analysis
Craters
Paint Adhesion
Wetting Problems

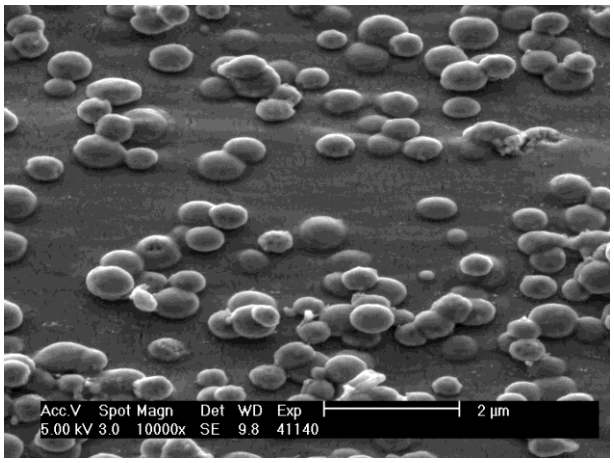

*Fig. 4: Metal underside in the **bubble zone** with relatively few anchor points.*

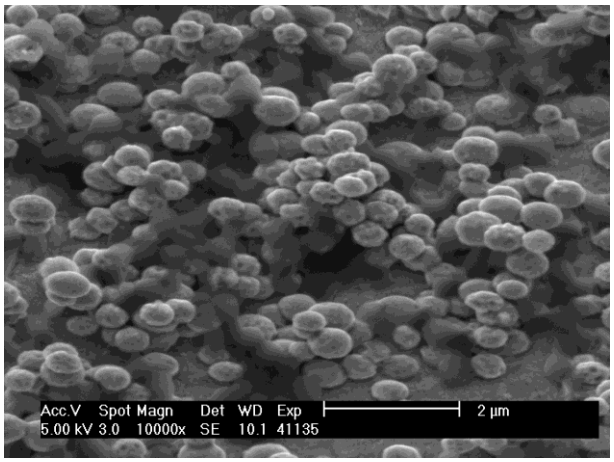

Fig. 5: Cleaned metal underside in the reference zone (many calottes result in a close connection with the polymer).

During electroplating, at first the butadiene component of the ABS is oxidized in an etch process. This leads to a formation of a cavern structure being filled with metal in the following prohcess steps – and this causes the anchoring. If the etching treatment is too little, (*Fig. 6a*), too few anchor points are formed. In case of a too strong etching (*Fig. 6c*), too few polymer webs remain – and this also results in a strength reduction.

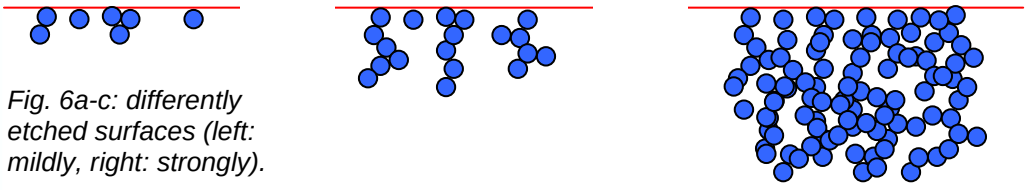

Fig. 6a-c: differently etched surfaces (left: mildly, right: strongly).

The advantages:

The method described allows a failure analysis of different defect types. It is also applicable to determine the elemental composition in the defect area and thus to identify possible foreign matter present there.

Interested?
The microscopy group of the Analytical Services Obernburg is ready to answer your questions and to help you.

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