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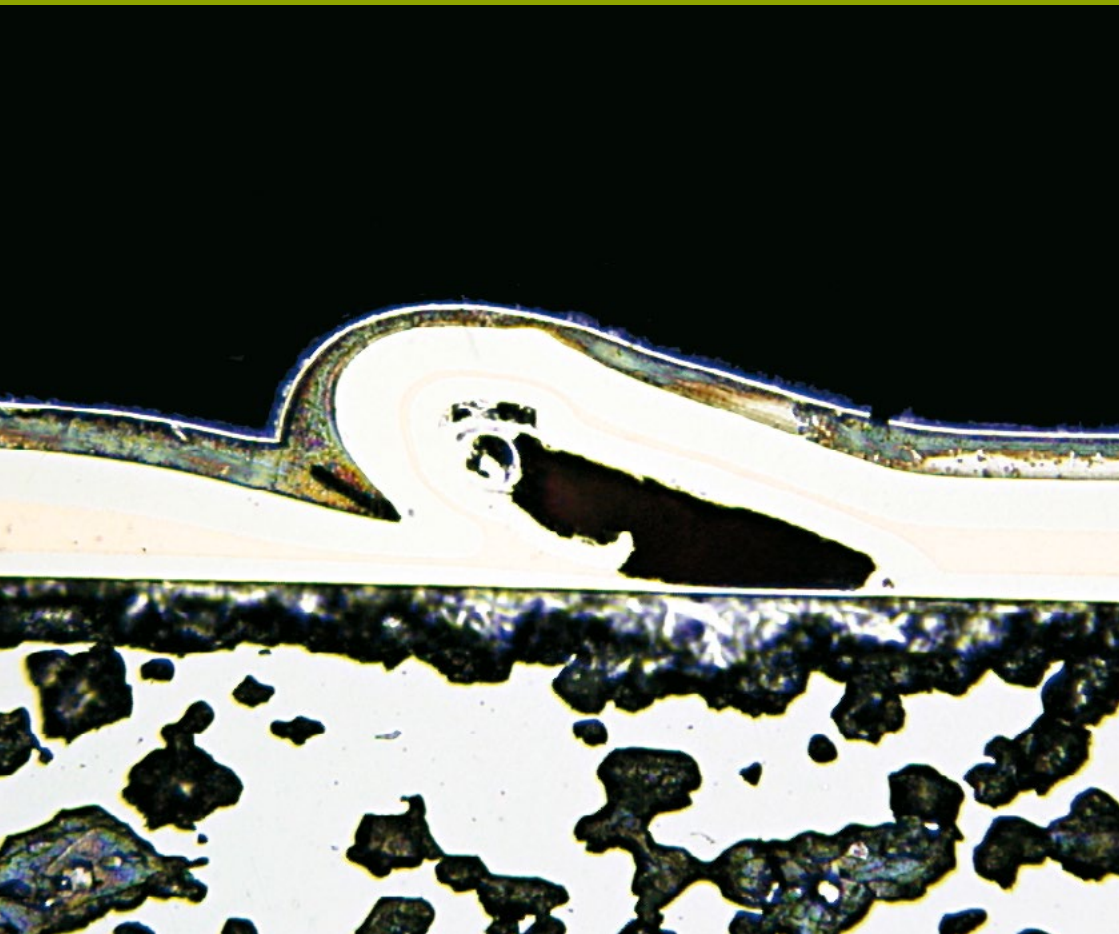
ANALYZING DEFECTS IN ELECTROPLATED COMPONENTS



DEFECTS IN ELECTROPLATED COMPONENTS

WE CAN HELP YOU!

PART OF OUR LABORATORIES:
THE METALLOGRAPHY

Defects or flaws in electroplated components either occur during the production process – where the defect is recognized at the latest during final inspection – or during practical use. Whatever the case, the result could be complete production failure or machine downtimes. This not only leads to financial losses but also could pose a threat to man or the environment if the component is used.

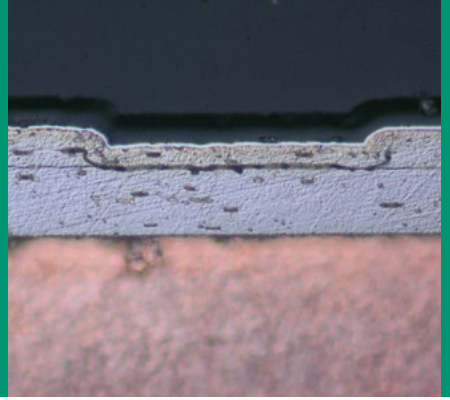
Therefore it is essential that a company reacts fast, and this is where we help our customers.

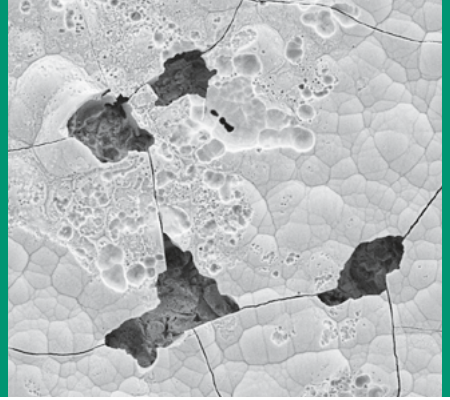
Such defects are due to a number of reasons. Wear and corrosion often cause premature component breakdowns, generally raising questions about whether something went wrong during the production process, whether the plating was not adapted to the conditions of use or whether the component was possibly implemented incorrectly. However, a wide range of problems can also occur directly when the plated component is being manufactured.

In most cases, these defects are only recognized at the end of the production chain. Depending on the product concerned, tiny microscopic pores or protrusions could be sufficient for a part to have to be rejected. This is the case, for example, for components for car interiors which need to convey elegance and quality, or for tiny bumps on the chromed surface of a printing roller which would be directly reflected in the printing quality of a glossy magazine.

In order to evaluate such a broad spectrum of possible defects and faults, and analyze defects as accurately as possible, in-depth knowledge and experience of the complete electroplating process chain as well as of plant management and design is essential.

A further important aid to characterize and analyze defects is metallographic and chemical analysis. A problem can only be solved efficiently if results are interpreted correctly, and if sound recommendations to remedy the defect can be developed based on such results.





DEFECT ANALYSIS IN PRACTICE

Defects in the field – Collecting detailed evidence

Problem
Flaking of the electroless nickel layer and signs of corrosion on the base substrate of a component for a wind power station relevant to safety. Corrosion only took place when the layer began flaking off but is now making it more difficult to determine the cause.

Analysis of the defect
Visible deformation of the nickel layer and substrate due to external mechanical stress.

Cause
Probably, either the coating selected was not adapted to cope with mechanical stresses, or the component was subjected to above-average stresses.

Defects in the production process – Downtimes and supply losses

Problem
High rejection rate during electroplating of plastic components in automotive area.

Approach
Assessment and categorization of the defect by way of metallographic tests. Based on this, on-site analysis of the production process up to carrying out maintenance of the plating unit. Correlation of results and development of corrective action.

Result
Due to the diversity of defect images, various measures are identified to reduce the reject rate and are prioritized accordingly.

Impact of substrates on plating

Problem
Numerous failure modes on plated plastic ventilation components.

Approach
Defect analysis by way of metallographic target preparation and assessment of production process.

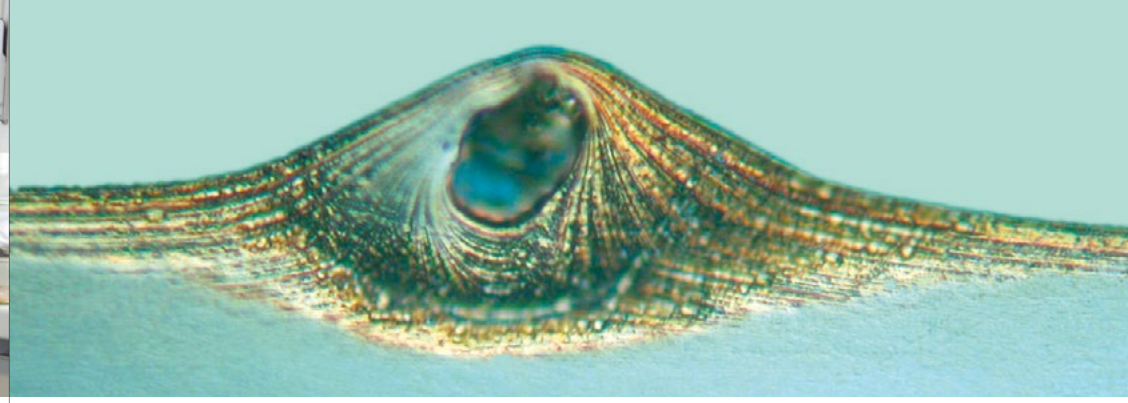
Result
Numerous causes result in a high number of failure modes. However, the plastic is shown to be one important cause. Inadequate injection molding parameters and non-adapted injection-molding machines give rise to inhomogeneities in the component, rendering it impossible to coat using conventional electroplating techniques.

Corrosion leads to defects

Problem
Chromium-plated special hotplates show signs of corrosion.

Analysis of the defect
Increased attack of the chromium layer causes the component to corrode and thus fail.

Result
Tests carried out on the surface indicate chemical attack of the chromium layer caused by chloridic solutions. As there are no obvious consistent defects in the layer structure, a plating error can be excluded.



KNOW-HOW
AS A BASIS OF DEFECT ANALYSIS

The focus of our work is on electroplating. This ranges from developing new plating materials, corresponding deposition techniques and process chains through defect analysis right up to industrial systems engineering.

A team composed of material technicians, metallographers, chemical technical assistants, chemists and material scientists with extensive experience in the field of electroplating enables defects to be characterized in detail. Our key to success is interdisciplinary collaboration.

The most important aspect is to ascertain a link between the defect and the production process. Among other things, this is achieved by performing an on-site analysis of all electroplating processes related to production. This involves assessing the condition of machines and components, such as product carriers and equipment periphery, right up to assessing the way individual workers carry out their tasks.

The interplay of our team's know-how and experience across the entire spectrum of electroplating topics forms the basis of targeted defect analysis.

In our laboratories, we take a close look at defects with the aid of metallographic tests. We generally carry out target preparations which enable sound data to be obtained – even about defects in the micrometer range. Chemical analytics allow almost imperceptible modifications in electroplating electrolytes to be detected which impair plating conditions and could cause defects

The methods we use to analyze materials:
- Metallography for the targeted preparation of samples and sections
- Scanning electron microscopy with energy-dispersive x-ray analysis
- X-ray diffractometer for analyzing structures and stresses
- Light microscopy with hardness testing

The chemical analytics methods we use to characterize electrolytes:
- Titroprocessor to analyze e.g. nickel and chromium ions
- Ion chromatography (IC)
- High performance liquid chromatography (HPLC) to characterize organic additives and degradation products

As a neutral independent partner, it is our responsibility to identify potential sources of defects, ascertain how defects are connected to production processes and develop appropriate corrective action.

WHAT WE CAN OFFER YOU!

We assess the entire electroplating process chain and ascertain links associated with the manufacture of the base substrate right up to usage of the component.

Fast reaction time
When a defect is recognized, a fast reaction time is vital as far as most companies are concerned. Only then follow-up costs can be reduced. We meet this requirement by performing fast, reliable analyses.

On-site analysis
Depending on the problem, one of our main services is on-site analysis in the electroplating workshop. Corresponding with the defect identified, we provide appropriate process support, plant maintenance and other electroplating steps related to production – even those that start at 5 o'clock in the morning!

Neutrality
As a neutral service provider, our main workfields are to analyze defects and find ways of remedying them. Further defects and rising costs can only be avoided by using results based on objective advice.

Applied worldwide
We investigate electroplating problems across the globe. This is because similar problems arise and comparable production processes are implemented throughout the world in the electroplating industry, irrespective of whether it is China, America or Germany.

Overview of our services
- Fast and reliable defect analysis
- On-site analysis of production processes related to electroplating – worldwide
- Characterization of corrective measures

Now it's up to you!
If you have defects in an electroplated layer or faulty components in a production process, don't hesitate to get in touch with us. We would be delighted to provide support and solve your problems!

OUR APPROACH TO DEFECT ANALYSIS

Define the defect (frequency, appearance)

Analyze the defect by way of defect characterization

iteratively

Analyze the electroplating process chain, especially on-site

Determine link between defect and production process (if possible, with regard to purpose of use in the case of failures in the field)

Indentify corrective measures

Provide process support during implementation of corrective measures

Verify results after implementation of measures

ELECTROPLATING AT FRAUNHOFER IPA

OVERVIEW OF MAIN WORKFIELDS

Development of new plating materials and plating systems

In order to fulfill increasing demands made of modern components, special solutions are needed for layer structures.

We provide:

- Further development and adaptation of conventional plating metals such as nickel and copper
- Development of innovative systems based, for example, on dispersion coatings for special applications

Methods and process chains

Our aim is not only to tell you what an ideal coating should look like but to provide you with a complete solution, including all the necessary process steps. The main focus is on applying coatings to complex geometries and defining process window tolerances.

Safeguarding the future using modern systems

As well as planning and carrying out project development work on electroplating systems, we also concentrate on developing and constructing special electroplating components. The main focus is on coating to final dimension, high-speed plating and selective coating from the aspects of energy efficiency and material efficiency. By collaborating with our design engineers and process developers, we can provide you with a competent team to solve a wide range of problems.

Supplier selection and assessment

Many companies purchase coatings which have to meet the highest demands. However, such companies don't often have the know-how to be able to assess processes and systems. We provide the necessary support when you have to take responsibility for such high-quality coatings.

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www.ipa.fraunhofer.de/electroplating

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