



# Aircraft Paint Damage and Failure Analysis

**With its Laboratory Services, Lufthansa Technik offers analytical investigations across all aviation materials and substances. To identify the root cause for paint failures, a broad range of analytical investigation methods is available advising on how to prevent future painting failures.**

The aircraft paint system serves a dual purpose. On the one hand it constitutes the optical sign of the airline's or aircraft operator's brand. On the other hand the paint system maintains the integrity of the airframe, protecting the surface from deterioration such as corrosion. To fulfil both requirements under the extremely demanding conditions of aircraft operations, paint manufacturers have developed highly sophisticated coating systems.

## Application is critical

During the paint application process however, and later during aircraft operation, numerous kinds of failures and/or paint damages can occur. Lufthansa Technik's Central Laboratory Services offers a broad range of investigation methods to identify the root cause of such failures and damages of paint systems. Based on the results of the investigation, the expert team gives advice on how to prevent future damage and how to improve the painting process.

## Extensive know-how

The Lufthansa Technik Central Laboratory Services Team together with the Aircraft Painting Services Team possesses extensive know-how and several decades of experience of failure analysis. Paint damage features such as cracks, blistering, pinholes, chipping and rivet rash can have numerous causes, such as improper pre-treatment of the surface, excessive thickness of individual paint layers or contamination of the paint.

## High-tech laboratory

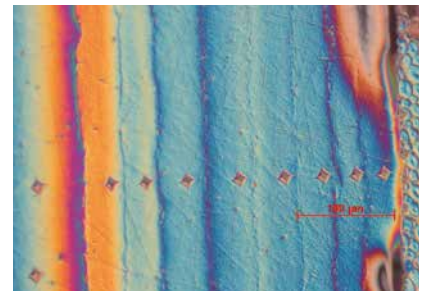
With its comprehensive know-how in aviation painting and high technology laboratory equipment available, the expert team of Lufthansa Technik Central Laboratory Services is able to perform in-depth failure investigations. For an overview of the destructive and non-destructive investigation methods as well as of Lufthansa Technik's mobile and stationary testing capabilities please turn to the back page.



Rivet rash deterioration of an aircraft painting



Paint cracks on composite structure



Cross section analysis of mechanical properties of paint system using nanoindentation



Lufthansa Aircraft – example of painted aircraft

## Contact

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Investigation	Selection of our equipment
<p><b>1. Independent paint failure and damage documentation</b>                      A complete documentation necessary for investigations of the paint damage/failure symptoms on the aircraft or component includes:</p> <ul style="list-style-type: none"> <li>• Description of the failure (e.g. position, distribution and size of paint damage and delamination)</li> <li>• Paint system layer thickness measurement</li> </ul>	<p><b>Mobile Equipment</b>                      Mobile microscope                      Paint borer – wedge cut method                      X-ray fluorescence spectroscopy (XRF)                      Spectrophotometer                      Gloss meter                      Cross cut tester (adhesion test)</p>
<p><b>2. In-depth paint failure analysis</b>                      To approach the possible root causes of failures Lufthansa Technik offers methods to evaluate:</p> <ul style="list-style-type: none"> <li>• Failure symptoms and characteristics</li> <li>• Composition and material group of the paint</li> <li>• Paint system macro- and micro-structure</li> <li>• Paint system layer thickness</li> <li>• Investigation of the substrate (if applicable) <sup>1)</sup></li> <li>• Failure root cause analysis</li> </ul>	<p><b>Stationary Equipment</b>                      Composition analysis                      Energy dispersive analysis by X-ray (EDX)                      Optical emission spectroscopy (OES, ICP-OES)                      Scanning electron microscopy (SEM)                      Fourier transform infrared spectroscopy (FT-IR)</p>
<p><b>3. Paint quality assurance and qualification</b>                      To certificate the quality of a paint system Lufthansa offers various tests:</p> <ul style="list-style-type: none"> <li>• Color measurement <sup>1)</sup></li> <li>• Gloss level measurement <sup>1)</sup></li> <li>• Metallographic examination</li> <li>• Paint adhesion test <sup>1)</sup></li> <li>• Hardness measurement</li> <li>• Tensile-, compression- and bending-tests</li> <li>• Accelerated weathering and corrosion test</li> </ul>	<p><b>Thermal analysis</b>                      Differential scanning calorimetry (DSC)                      Thermo-gravimetric analysis (TGA)</p> <p><b>Macro- and microstructure analysis</b>                      Stereo/light microscope</p> <p><b>Quality assurance</b>                      Fischerscope® HM2000 S (hardness test)                      Tensile test machines                      Temperature/humidity chamber (artificial aging)</p>
<p><sup>1)</sup> mobile investigation</p>	

How-to guide	Shipping address:	Required information:
<p>If you are interested in trying our service, we suggest that you proceed as follows:</p> <ol style="list-style-type: none"> <li>1. Contact our Laboratory Service team for any question.</li> <li>2. We will provide you a proposal for the individual failure analysis. Sample delivery/shipping</li> <li>3. We recommend that the samples are firmly sealed and clearly labelled.</li> </ol>	<p>Lufthansa Technik AG                      Laboratory Services                      Paint Analysis                      Department HAM TQ/M                      Building 250, Room 241/Bhf. 36                      Weg beim Jäger 193                      22335 Hamburg, Germany</p>	<ul style="list-style-type: none"> <li>• Material data</li> <li>• Location of the failure</li> <li>• Component description</li> <li>• Operator/part number</li> <li>• Painting protocol</li> <li>• Sampling documentation</li> </ul>
		<p><b>Supplementary:</b></p> <ul style="list-style-type: none"> <li>• Purchase Order</li> <li>• Contact information incl. e-mail address</li> </ul>