

## One-Stop Shop for Industrial Process Problem Solving, Consulting and Routine Analysis

### Welcome to the September 2023 edition of LPD Lab Services newsletter

LPD Lab Services are the experts in materials, chemicals, technical engineering and scientific problem solving for products and manufacturing processes within Quality, Facilities, Manufacturing, Engineering and Development and Research.

LPD Lab Services develop innovative and practical analytical solutions. In addition, we offer bespoke testing methods for in-process manufacturing, finished products and field failure issues as well as for the development of new products and materials. Our Staff pride themselves in resolving some fascinating and complex technical problems from across diverse product ranges and sectors of industry.

The laboratory offers scientific and engineering solutions with timely response times and clear communications which are all core to the company's business model.

#### This edition at LPD Lab Services:

- Materials and Product Failure Investigations.
- Lab Instrument Selection, Method Development and Technology Transfer.
- Microbial Induced Corrosion - MIC of Metals.
- Filter Blockage and Blinding Investigations.

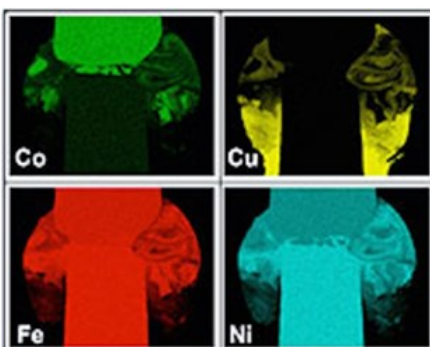
## Materials and Product Failure Investigations

Wide-scale failures in mass manufactured products generally occur due to defects in a material or manufacturing process, as well as field environmental factors during service in the application. This can have a widespread and often costly impact; loss of reputation, reduced lifetime expectancy of the product or larger failures in assembled parts. All of which can have long lasting effects on a business and reputation.

Understanding the defects, vulnerabilities and potential root causes of weakness in a material is essential for preventing future large-scale failures and ensuring product quality. This can apply to metal corrosion, premature embrittlement or cracking of plastics and hardening of rubbers, as well as coating failures.

The experienced LPD Lab Services technical staff - along with the huge variety of analytical techniques we offer - mean the problem can be investigated to determine the likely causes of weakness or incompatibilities in the product and suggest improvement to product and processes as containment actions or solutions. This is generally done by comparing a faulty component to a non-faulty one, looking for physical and chemical differences in the materials or process change points. It can also be possible to predict whether other components are likely to fail from the same mechanism.

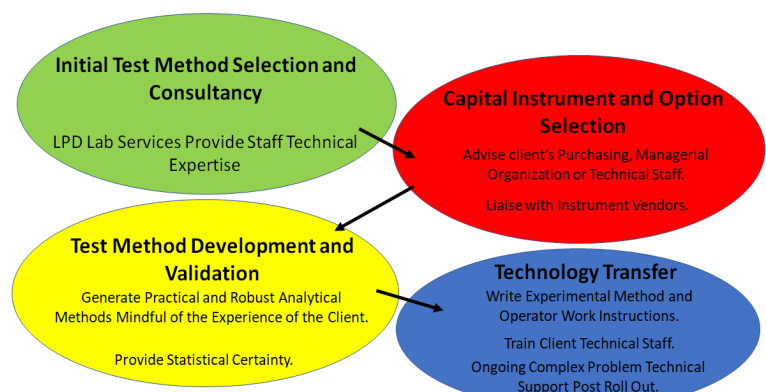
Identifying defects can extend a components useful lifetime and prevent premature failure. This will result in cost savings in the future, reducing maintenance costs, frequency of component replacement, process downtime and product reject issues.



Additionally, LPD can assist in the testing of suspect faulty products, ensuring products are to the quality standards of the client and can endure their expected lifetime.

## Lab Instrument Selection, Method Development and Technology Transfer

For chemicals and materials characterization, selection of the right analytical instruments and development of appropriate test methods are critical for cost effective capital investment and wider project support. This requires experienced staff to help in the selection process and evaluate the different instrument vendors specification options, as this can be confusing and potentially misleading. Ease of operation, instrument reliability and performance - including detection and quantification limits - all feed into the decision and this, in turn, affects the type and cost of the operator, in a time where suitably experienced analysts are difficult to find. These are all critical in rolling out a cost effective quality control laboratory technique and methodology. LPD Lab Services offers all of these consultancy services including handover and cross-training to the client's staff. The lab are then on hand to offer further technical support if complex problems arise.



Instruments can be temporarily or permanently installed at LPD Lab Services for routine analysis before potential transfer onward to the customer. There may be cases where the client wants to treat the lab as a pilot facility, before rolling out the new methods to multiple sites for technician running of the developed analytical methods. LPD Lab Services can offer a support service if a client is not able to recruit the experienced staff to develop and validate methods in-house. The client may instead decide to use LPD Lab Services to continue to conduct tests - or can use the laboratory as an experienced back up facility - in case its own in-house testing develops difficulties or breaks down to reduce consequential process downtime.

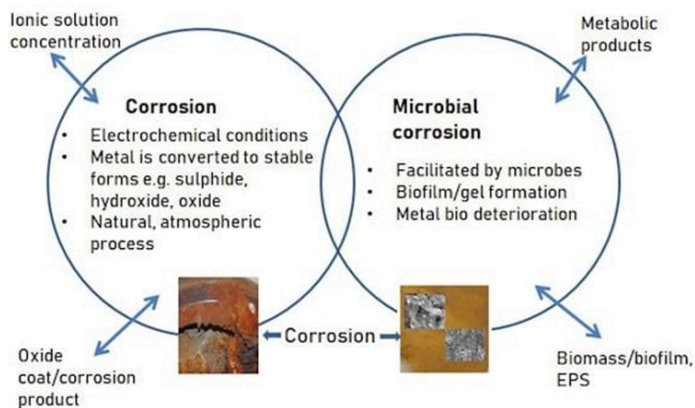
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## Microbial Induced Corrosion - MIC of Metals

Microbial Induced Corrosion (MIC) is a type of metal corrosion and is driven by the presence and activity of micro-organisms. It is estimated that about 10% of all corrosion to metals and non-metals are caused by microbial activity. One example of MIC is the anaerobic corrosion of iron and steel. MIC is almost always associated with biofilm formulation which is a gel-like substance, composed of a mixture of about 95% water, extracellular polymeric substance (EPS), a suspension of cells, and inorganic matter.

Microbial corrosion is common in industries with high usage of salt and fresh water or chemicals in their operations: building facilities, marine, shipping and nuclear power generation, on and offshore oil and gas, underground pipelines, water treatment, heat exchangers, storage tanks and flange joints.

Four main groups of bacteria are associated with MIC: sulphate-reducing bacteria, slime-forming bacteria, metal depositing bacteria and sulphur-oxidising bacteria. These can be missed or misinterpreted in more conventional corrosion investigation approaches, but LPD Lab Services are experienced in spotting and diagnosing MIC.



The complexity of MIC reactions means that a broad range of techniques must be employed to relate the corrosion processes to the microbial activities at solid surfaces and in liquid samples.

Microscopic techniques - specifically optical microscopy and SEM- provide information about the morphology of microbial cells and colonies; their distribution, the presence of EPS and the nature of corrosion products.

Chemical analysis like ICP-MS can be used to identify species like copper, iron and manganese in solution. IC can be used to identify weak organic acids, such as from breakdown of glycol antifreeze, and anions, like sulphates and nitrates, that can promote bacterial activity. GC-FID and GC-MS can be used for the identification of volatile organic compounds in the sample medium.

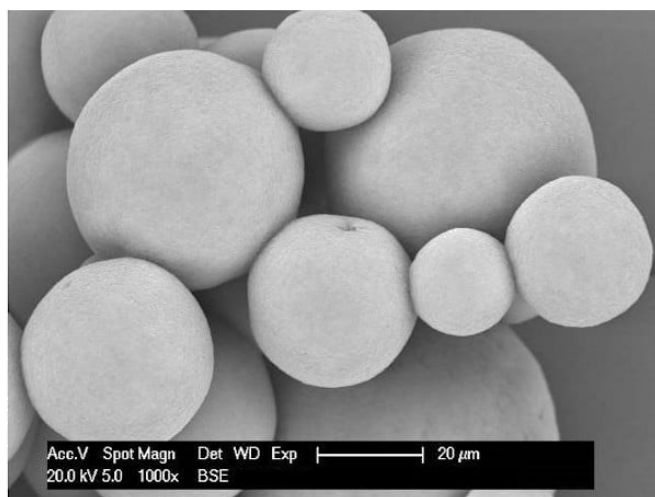
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## Filter Blockage and Blinding Investigations



Manufacturing / power plants and domestic / commercial buildings use filter systems to protect equipment and infrastructural facilities from blocking and premature failure. It is important to understand what the material collecting in the filters is made of and where it has come from to work out how to prevent or reduce the problem. This will result in saving money due to requiring less frequent maintenance and reduction in damage to infrastructure.

LPD Lab Services frequently carries out analysis of blocked or partially blinded filters from air, gas and liquid handling systems to determine the chemical and physical nature of the debris, using combinations of Optical Microscopy, SEM/EDX, FTIR Microscopy, GC-MS, IC, semi-quantified XRF, AAS and ICP-MS.



The initial material nearest the outlet of a filter can be of prime interest, as this is often the start or cause of the blockage, with the material backing up behind it being the victim, rather than the cause. Thus the lab can advise on sensible choice of sample locations within the filter, or from the wider facilities, to allow type matching or fingerprinting back to the original source of the problem generating material.