1. STRENGTH TESTING
2. HARDNESS TEST
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6. POLYMER IDENTIFICATION TEST

Materials testing is an essential part of quality management for manufacturers. The cost of not conducting routine material tests can be severe, leading to product recall, or admission of responsibility for failed parts. With careful planning and a collaborative approach with One Eighty this risk could be reduced up front.

Materials testing is also an essential part of problem solving. Manufacturers or end users who experience recurrent failures need to test the material to establish the root cause of the problem and mitigate losses. At One Eighty we think that materials testing should be an integral part of manufacturers quality management system, for preventative action and corrective action. We offer a wide range of materials testing services and are able to test any engineering material or coating including metals, plastics, composites and ceramics. This leaflet is designed to help guide you in making an informed decision.

www.one-eighty-degrees.com
WHAT IS STRENGTH TESTING?
TO FIND OUT THE LOAD REQUIRED TO BREAK MATERIAL.

Tension, compression or bending testing supplies information such as ductility, the yield strength and ultimate tensile strength. From this we are able to tell you whether the material is likely to crack when a load is applied, or if it will deflect or change shape at a lower load than the failure load.  www.one-eighty-degrees.com
HOW CAN THIS HELP YOU?
As a fabricator or manufacturer you need to check that the material that you have ordered has the correct strength. Sometimes it is also necessary to test the strength of a weld. We are able to conduct this test for you with guaranteed results.

THE ONE EIGHTY ENGINEERING SOLUTION
A client asked us to find out why some bolts failed prematurely. The bolt manufacturer was concerned that the material did not comply with specification, because the material may not have been given the right heat treatment. Samples were machined from the bolt material to ASTM standards and tested in a tensile tester. Our tests showed that the material was compliant with specification, absolving the manufacturer from the responsibility of the failure.
WHY CONDUCT A HARDNESS TEST?
TO ESTABLISH A MATERIAL HEAT TREATMENT CONDITION.

A steel ball (Brinell Hardness) or diamond prism (Vickers & Rockwell testing) is used to make an indent in the material. Based on the degree of indentation, we are able to quantify the hardness of the material.  www.one-eighty-degrees.com
HOW CAN THIS HELP YOU?
Steels have different hardness levels depending on their heat treatment condition. A normalised steel has been slow cooled from high temperature and has low hardness, but can be easily welded. A steel that has been cooled quickly from high temperature and then tempered at a lower temperature will have a higher hardness and greater strength, and can be used for heavy duty shaft applications. A hardness test can tell us what heat treatment condition the material is in.

ONE EIGHTY ENGINEERING SOLUTIONS
A glass bottle manufacturer could not explain why their cast iron moulds did not last as long as they expected, causing the cost of bottle manufacture to increase unacceptably. By conducting a hardness test we are able to show that the material did in fact have sufficient hardness and that other root causes should be investigated. Consequently the problem could be solved, allowing the life cycle of the moulds to increase. The cam on a diesel engine on board a fishing vessel failed prematurely. Hardness tests were conducted on a section through the failed surface. We found that the case hardened depth was insufficient which lead to premature failure of the cam.
WHY DO A COMPOSITIONAL TEST?
TO FIND OUT WHAT THE MATERIAL IS AND ALSO ITS GRADE.

All materials are made up of elements in the periodic table, like steels which are alloys of iron, carbon and manganese. By adding other elements to steels a wide range of alloys can be created. Using a spectrometer, we conduct a spark analysis, which is the most accurate method of measuring the chemical composition of materials.  www.one-eighty-degrees.com
HOW CAN THIS HELP YOU?
With so many different types of materials available today, for example, titanium alloys, nickel alloys, copper alloys, stainless steel and carbon steels it becomes essential to know the chemical composition of the material so that the correct replacement can be found or manufactured.

THE ONE EIGHTY ENGINEERING SOLUTION
1. A foundry that manufactures brass components routinely needs to show that the alloy complies with specific composition standards. We were asked to conduct a routine compositional test and supply a compliance certificate.
2. A manufacturer who sources material from China needs to routinely conduct compositional analysis to check that the material complies with the certificate supplied, as the consequences of using the wrong or inferior material could be severe.
WHAT IS LIGHT MICROSCOPY? IDENTIFYING MICROSTRUCTURE UNDER A LIGHT MICROSCOPE.

All materials have a microstructure. This is the fingerprint of the material. To identify key features of the microstructure, we mount a sample of the material in plastic resin, grind it down and polish it to a mirror surface finish. Then we treat the surface with chemicals before placing it under a light microscope. Our metallurgist can identify those key features that are significant to strength, corrosion resistance and general performance of the material. www.one-eighty-degrees.com
HOW CAN THIS HELP YOU?
When parts have corroded, we are able to determine by viewing the microstructure how the corrosion occurred. Features such as stress corrosion, cracking or sensitisation that occurs in stainless steels can be identified. It is possible also to determine if case hardening has been done properly by investigating microstructural changes.

THE ONE EIGHTY ENGINEERING SOLUTION
The wine tank manufacturer for a wine maker in Stellenbosch approached us. The reason for leaking tanks was unclear until we investigated the samples under the light microscope. We found that evidence of stress corrosion cracking was consistent on a number of the samples. This we associated with poor welding. The manufacturer was able to make the right decision regarding the repair of the tanks, as well as alter the manufacture process for future orders.
WHY USE SCANNING ELECTRON MICROSCOPY?
BY USING ELECTRONS INSTEAD OF LIGHT, GREATER MAGNIFICATION IS ACHIEVED.

Sometimes the structure of a material is so small, it cannot be seen under a light microscope, like Aluminium alloys for example. Fracture surfaces are best seen with an electron microscope. The features of a fracture surface under electron microscope can reveal whether failure occurred by fast fracture or fatigue.  www.one-eighty-degrees.com
HOW CAN THIS HELP YOU?
The electron microscope has the advantage in that you can measure the composition of anything you can see in the structure. You could see what elements are in corrosion products and from this define what caused the corrosion.

THE ONE EIGHTY ENGINEERING SOLUTION
A faulty galvanised pipe was brought in for microstructural investigation. We imaged the pipe in the electron microscope. Various irregularities in the coating could be seen that were not visible with the light microscope. Composition measurements could be taken on the galvanised layer to explain these irregularities. Corroded pipes were brought for analysis. By analysing the corrosion product in the perforated areas the corrosion could be linked to poor water treatment.
WHY CONDUCT A POLYMER IDENTIFICATION TEST?
TO DETERMINE THE TYPE OF PLASTIC.

There are various tests that can be conducted but usually an FTIR test is conducted to see which molecules are present in the material. Density measurements and melting point measurements can also be done.  www.one-eighty-degrees.com
HOW CAN THIS HELP YOU?
If you have a plastic part and need to know what has been used to manufacture it, our polymer identification tests can be done to determine the exact material.

THE ONE EIGHTY ENGINEERING SOLUTION
Our client approached us to identify the polymers used in a tank that was manufactured and sourced overseas. With the less favourable exchange rate, it made financial sense to manufacture the tanks locally. We identified the polymers and made recommendations for alternative polymers that were available locally. The original polymer was not found in South Africa, but by understanding the material we were able to recommend a better local product than the imported version.
FOR OTHER SERVICES AT ONE EIGHTY

- Expert witness
- Root cause failure investigation
- Contract research and development
- Problem solving
- Materials selection and product design

To find out more please visit our informative website at www.one-eighty-degrees.com where we have an extensive list of case studies for you to browse. Alternatively why not give us a call and get our mind on your problem.

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