



HERRERA, STAFFORD & ASSOCIATES

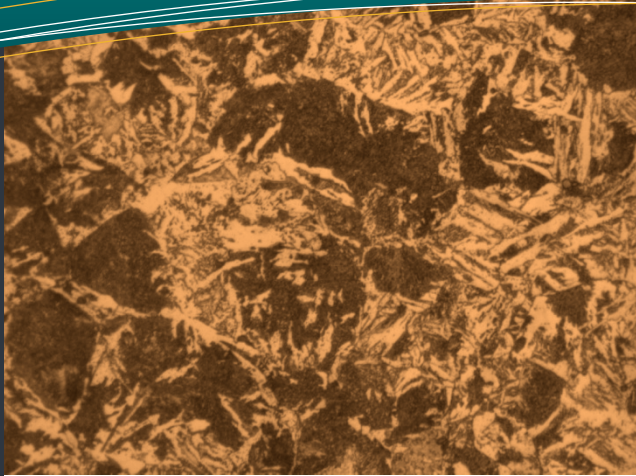
QUESTIONS... WE PROVIDE ANSWERS

Our team of engineers has expertise in a wide range of areas from turbine components to electronic devices. We have a full-service metallurgical laboratory ready for your utilization.

Take a lab tour today and learn how we can help your organization.

MATERIAL TESTING AND EVALUATION

- Tensile Testing
- Impact Testing
- Hardness Testing
- Fracture Surface Evaluation
- Welding Procedures
- Metallography
- Materials Evaluation
- Chemical Analysis
- Corrosion Coupons
- Fracture Mechanics
- Non-Destructive Evaluation
- Metallographic Replication
- Field Chemistry
- Field Hardness



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Our Company, Your Solution

Herrera, Stafford and Associates (HSA) is a materials engineering consulting firm. We specialize in failure analysis and provide various types of materials testing. We have served as technical consultants to many industries including oil and gas, medical devices, and electrical devices.

HSA was founded in 2002 by Juan Herrera and Stephen Stafford as a metallurgical and accident reconstruction consulting firm. Our team of engineers has a combined 55 years of experience. Please refer to page two "Meet Our Engineers" to review their areas of expertise. The firm has ongoing relationships with various organizations in oil & gas, energy, litigation, civil, medical devices, aeronautical, and electronics companies.

HSA has recently moved to a new location, which has expanded our laboratory capabilities. We are ready to serve your organization with material testing and metallurgical evaluations.

Our facility has two scanning electron microscopes, multiple light microscopes and stereoscopes. HSA has machining capabilities, Charpy impact testing and hardness testing. Our chemical analysis equipment includes energy dispersive x-ray spectroscopy (EDS), x-ray fluorescence spectroscopy (XRF), and optical emission spectroscopy (OES) for elemental analysis and metal and alloy identification. Please refer to page three "Capabilities and Pricing" for a full listing of the services we offer.



Stephen Stafford, Ph.D., P.E. - Owner and Consulting Engineer

Dr. Stafford has had an extensive and varied academic service record with broad industrial and practical experience. He began his career as a steel production engineer with ARMCO (Houston) in melt shop operations. This experience was extremely beneficial to formulating manufacturing processes and product service performance. Two of his more challenging project areas dealt with the steel for the Trans-Alaskan pipeline and for the United States Navy's nuclear submarine fleet.

Since 1975, he has performed failure analysis and material characterization studies on a consulting basis for a large number of manufacturers, many of which have involved litigation and manufacturing liability claims. In 1978, Dr. Stafford and Dr. Juan M. Herrera incorporated as **Met-Tech, Inc.** (Texas) to provide the means to expand their engineering consulting services. Met-Tech, Inc. now is strictly involved in steel fabrication. In 2002, Drs. Herrera and Stafford formed a new LLC strictly dedicated to consulting engineering – **Herrera, Stafford and Associates.**

Dr. Stafford is currently a professor in Metallurgical and Materials Engineering. In 1980, he devised a senior engineering course in failure analysis and has taught this course for almost every semester since.

In addition, he has worked closely with El Paso Natural Gas, El Paso Corporation (now Kinder Morgan Inc.) as a consulting engineer. His projects have focused on a wide array of gas compression equipment, gas transportation systems, reciprocating engines and land-based turbines. In this capacity, he has grown in the areas of nondestructive evaluation, structural integrity assessment, fracture mechanics, corrosion deterioration mechanisms, weld fabrication and reverse engineering of structural components.

MEET OUR ENGINEERS

Our staff of UTEP educated engineers, four PhD's and two licensed Texas professional engineers have a range of specialties intended to meet your company's needs.

Shalayna Lair Smith, PhD, PE – Senior Engineer

Dr. Smith specializes in failure analysis investigations of machinery and piping involved with the transportation of natural gas. Investigations have included corrosion analyses of piping and machinery, stress corrosion cracking (SCC) evaluations, hydrostatic test failures, in-service leaks and ruptures of pipe, in-service failures of compressor engine components and evaluation of inspection defects. Experience with litigation projects and interaction with regulatory agencies (DOT-PHMSA and state regulators) during field response and laboratory analyses have strengthened her engineering expertise.

Additionally, Shalayna can provide on-site support and emergency response for major pipeline and compressor station failures. This includes fieldwork and coordination with pipeline operators as well as performing fitness-for-service evaluations, field photography, collection of failed components, field hardness measurements and in-place metallography and replication. Other areas of experience include working with weld procedure qualifications, material selection issues and metallurgical life assessments of turbine components.

Christopher Bradley, PhD – Associate Engineer

Dr. Bradley supervises laboratory management and conducts failure investigations and material characterization. He has experience with a variety of steel and stainless steel components used in oil and gas industry, aluminum, copper and brass alloys, and various superalloys used in turbine industry.

Chris has interned with National Aeronautics and Space Administration (NASA) in Houston, TX. While there he worked with friction stir welding, microstructural and mechanical characterization and testing of 2195 aluminum.

As a graduate research associate for the Center for Space Exploration Technology Research (cSETR) he worked on the deposition of nanostructured thermal barrier coatings using RF magnetron sputtering technique used for turbine applications.

Brenda Machado, PhD – Associate Engineer

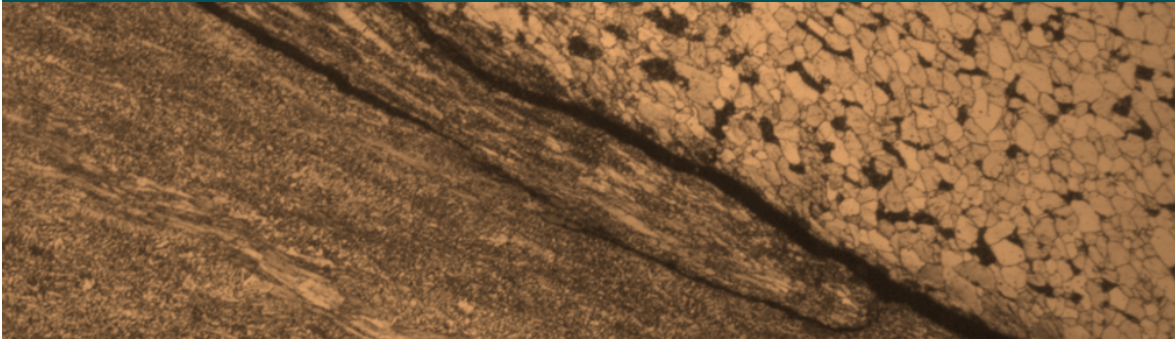
Dr. Machado manages the EM coupon program, which monitors corrosion in the natural gas pipeline industry. She analyzes steel surfaces exposed to natural gas environments and obtains relevant information for corrosion control.

As a graduate student, Brenda worked on different projects involving additive manufacturing to fabricate cellular structures from titanium and copper and she performed transmission electron microscope (TEM) on different materials like low-temperature nanoparticles.

She is skilled in optical and electron microscopy, Energy Dispersive X-ray Spectroscopy (EDS), X-ray Fluorescence (XRF) and Nondestructive Testing (NDE).

Sharon Lagunas – Associate Engineer

Mrs. Lagunas performs corrosion analysis on EM Corrosion Coupons for natural gas pipelines. She processes the coupons and performs optical and SEM examinations. Sharon worked as an intern at El Paso Corporation analyzing components to determine the cause of failure. While performing the failure analysis process she utilized a variety of equipment including optical emission spectroscopy and scanning electron microscopy. Sharon also worked as a metallurgical laboratory technician at Phelps Dodge. She performed quality testing as well as daily, weekly and monthly data logging and input.



INDUSTRIES WE SERVE

Oil & Gas – Compressors, gears, pistons, weld procedures, inspections, machinery failures, corrosion related issues, and pipeline failures.

Power and Utilities – Analysis of gas and steam turbines, piping systems, boilers and boiler tubing, material life assessment.

Litigation/Product Liability – Insurance defense, personal injury, accident investigation, general litigation support, expert witness testimony.

Refineries – Heat exchangers, pipeline systems, refractory material, and on-site characterization.

Aerospace – Turbine engine components and thermal barrier coatings (TBC's).

Automotive – Automotive components.

Medical devices – Failure analysis and litigation support.

Electronics – Integrated circuits, high voltage components, and electro-deposited coatings.

Structural Manufacturing Products – Copper, aluminum and steel industries.

Infrastructure – PVC piping, structural lighting systems.

CAPABILITIES AND PRICING

Chemical Analysis of Metals and Alloys

This testing is usually performed to confirm whether elemental content meets the specification requirements. This testing can also be effective to determine the presence of surface contaminants.

| | |
|-----|-----------------|
| XRF | \$50.00/sample |
| OES | \$85.00/sample |
| EDS | \$100.00/sample |

Field Examinations & Inspections

Inspections of equipment and facilities generally require on-site examinations. Therefore, failure investigators should be some of the first individuals to arrive on the scene of industrial incidents. Assignments that include travel to customer sites are billed on the basis of portal-to-portal:

| | |
|------------|---------------|
| Technician | \$50.00/hour |
| Engineer | \$100.00/hour |
| Consultant | \$250.00/hour |

Technical Photography

Close-up photography and other forms of technical photographic documentation can be provided.

\$100.00/hour

Price includes image processing

Metallurgical Report Preparation

Includes examination of data compilation, research, writing and assembly of technical report.

| | |
|------------|---------------|
| Engineer | \$100.00/hour |
| Consultant | \$250.00/hour |

Mechanical Testing

Mechanical testing can determine various strength, hardness, elastic and plastic deformation properties to compare to mill test reports or specification requirements.

| | |
|------------------------|------------------------|
| Macro Hardness Testing | \$25.00/sample* |
| Microhardness | \$75.00/sample and up* |
| Tensile Tests | \$60.00/sample and up* |

*Prices are dependent on sample preparation required for testing

Metallographic Evaluation

Sample preparation and photographic documentation of microstructural features. Pertinent features relating to grain size, microconstituents, fabrication and processing history can be revealed by metallographic examination.

| | |
|------------------------------------|-----------------|
| General microstructural evaluation | \$265.00/sample |
| Inclusion rating (visual) | \$75.00/sample |
| Grain size (ASTM E112) | \$75.00/sample |
| Macro-examination of welds | \$125.00/sample |

Scanning Electron Microscopy (SEM)

SEM allows close-up and high magnification/resolution viewing of various objects. It is commonplace in failure analysis, but also serves multiple purposes in materials characterization.

*Price on Request

Failure Analysis

Most projects require a preliminary inspection from which a work scope or proposal of work is provided to the customer. This includes what will be performed and the cost. The results and analysis are documented in a report, which includes recommendations to eliminate future failures.

*Price on Request

Materials Selection

With over 60,000 different materials available for engineered products, it is helpful to prioritize design/service requirements and optimize performance outcomes.

*Price on Request

Field or In-Situ Metallographic Replication

Instead of in-laboratory preparation, the metallographic technique is brought to the component. This has been used successfully to assess service-induced alteration due to temperature and chemical conditions.

*Price on Request

Finite Element Analysis (FEA)

Stress modeling is very effective when used in concert with failure analysis techniques.

*Price on Request

***Price on Request** - A personalized quote including all costs will be provided based on the size of materials and extent of the project. This helps ensure a cost effective analysis that provides the answers our clients require.

CONTACT INFORMATION

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LAB TOURS

Please feel free to contact us for a laboratory tour. We will show you our capabilities and provide you with information on how we can assist you with your metallurgical issues.



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