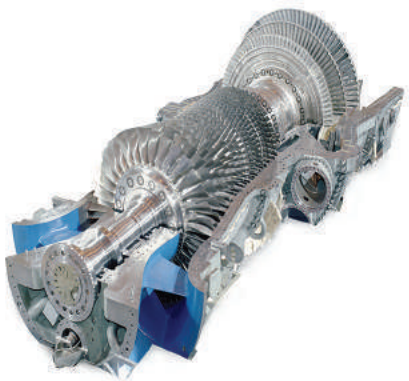
Razi Metallurgical Research Center (RMRC)



Materials Characterization and Selection

Integrity Management

Failure Analysis, Fitness for Service and Life Assessment

30-year research experience alongside the industry, instructed us how to benefit from Collective wisdom

Materials Characterization & Selection department

Materials Characterization & Selection department of RMRC with more than 30–year work experience in research projects and collaboration with many industries including Refineries, Petrochemical, Power Plants, Aviation and Aerospace industries, Machine and Automobile Manufacturing, Rail & Transit industry, Marine equipment, Mining and Cement, Civil and Medical Services offers research and consultancy services with the highest quality, lowest price in the shortest time.

Brief description of capabilities and activities performed by this department is :

- Identification of damage mechanism caused by corrosion, Fatigue, Corrosion/ Fatigue, Creep, Creep/Fatigue, oxidation and so on
- Failure analysis, fracture mechanics and measurement of the crack growth rate
- Remaining life assessment and fitness for service
- Evaluating and checking of permitted tolerance for defects of engineering structures and welded parts
- Industrial projects about development of alloys, superalloys, refractory alloys, and wear-resistant alloys
- Selection of Materials and Reverse engineering

Our Capabilities

- **Integrity Management**

  Failure Analysis

  Life Assessment

  Fitness for Service

- **Materials Selection and Corrosion Management**

  Failure Analysis and Characterization

  Welding Consultation

  Welding Metallurgy and weld ability

- **High Temperature Mechanical Testing**

Fitness for service

Remaining life assessment of equipment and parts which are constantly degrading in working condition as well as determining technically proper condition and ensuring safety of staff are all the matters with crucial importance in various industries. Fitness for service (FFS) is the effective method for optimizing the conservation and implementing the required measures in order to improve long-term economic performance of industrial equipment such as pressure vessels, tubes and storage tanks.

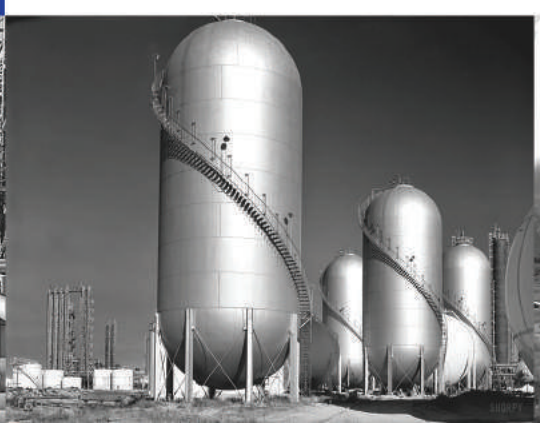
Moreover, FFS is a practical solution to study the reliability of welded structures in Chemical, Oil and Gas, Electricity Generation and Aerospace industries.

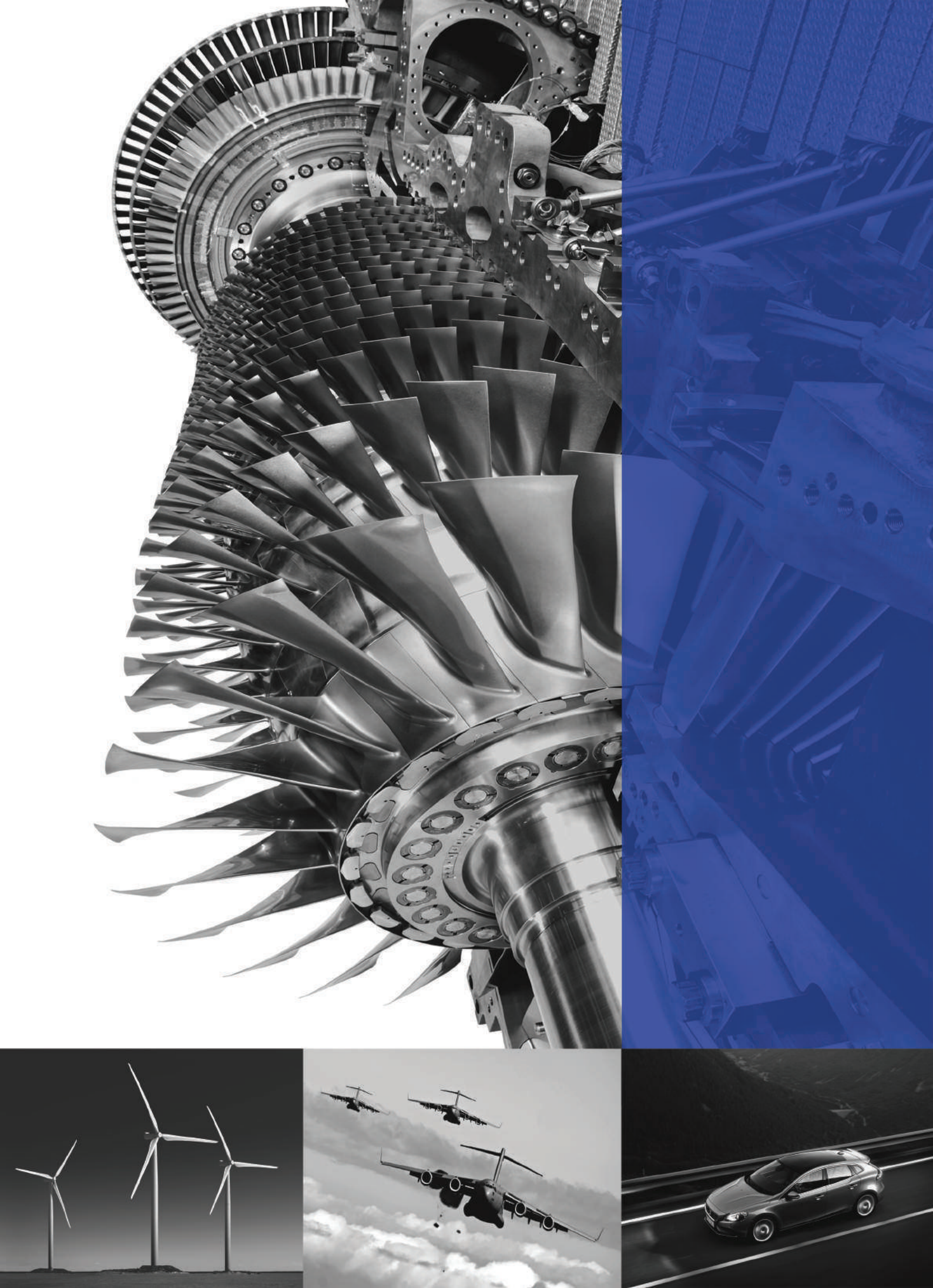
Razi Metallurgical Research Center as a leading center in FFS Analysis offers various services in three levels of evaluation mentioned below:

- Comprehensive assessment with high performance
- Finite element analysis for assessment of component
- Consultancy service with precautionary approach in order to prevent failure
- Evaluation of equipment utilized in industrial units
- Corrosion assessments
- Nondestructive tests

Some of RMRC clients in this area are:

- Arya Sasol Polymer Company
- Abadan Petroleum Refinery
- Petroleum Refinery of Shazand Arak
- Amirkabir Petrochemical
- Maron Petrochemical
- National Company for Refining & Distribution of Petroleum Products
- Bandar-abbas Petroleum Refinery
- Farvaresh Bandar-Emam Petrochemical
- Shazand Power Generation

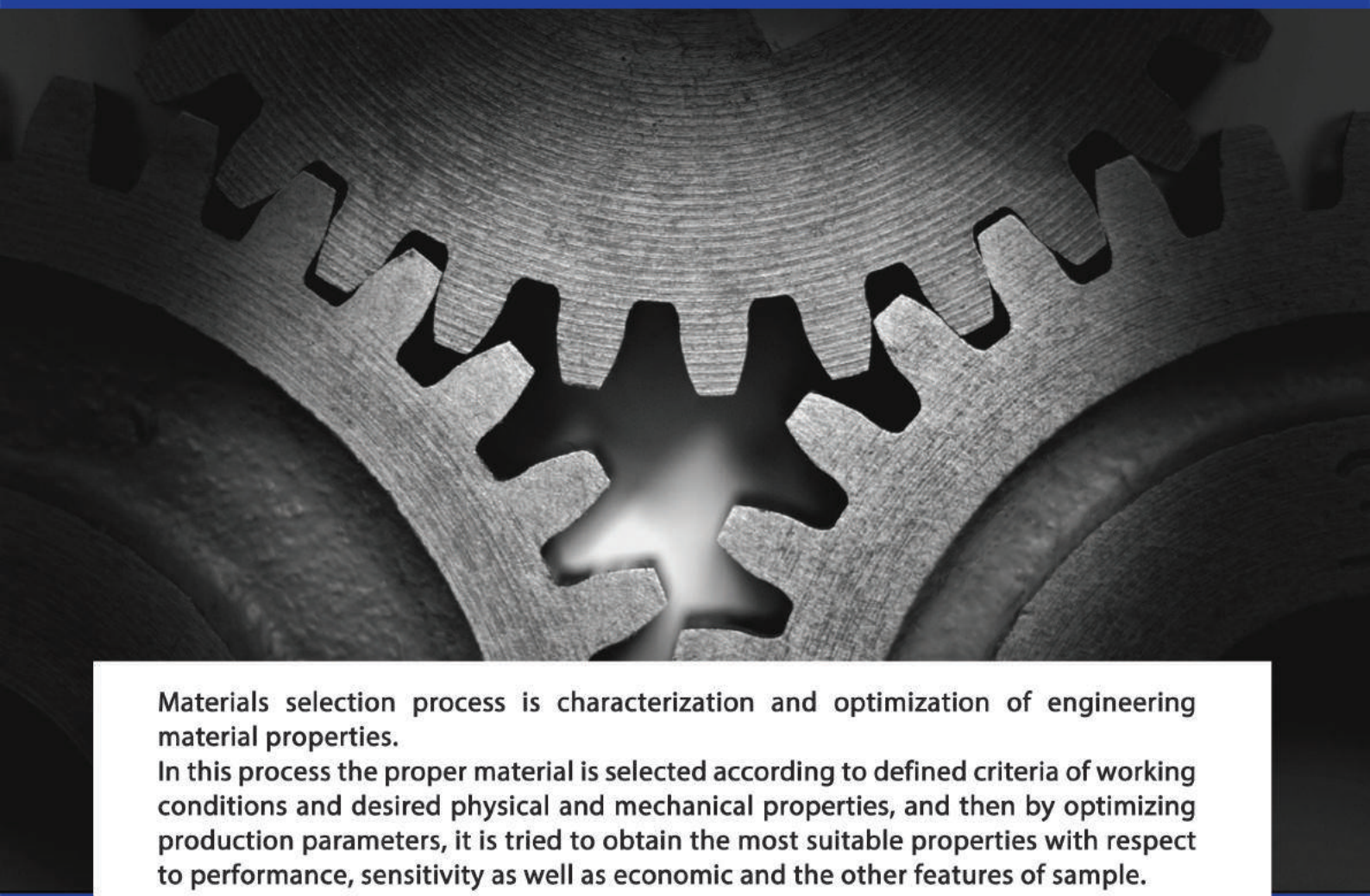
Welding consultation

welding is one of the most common techniques for joining and manufacturing in industry.

Razi Metallurgical Research Center has provided supervisory and consultancy services to the following:

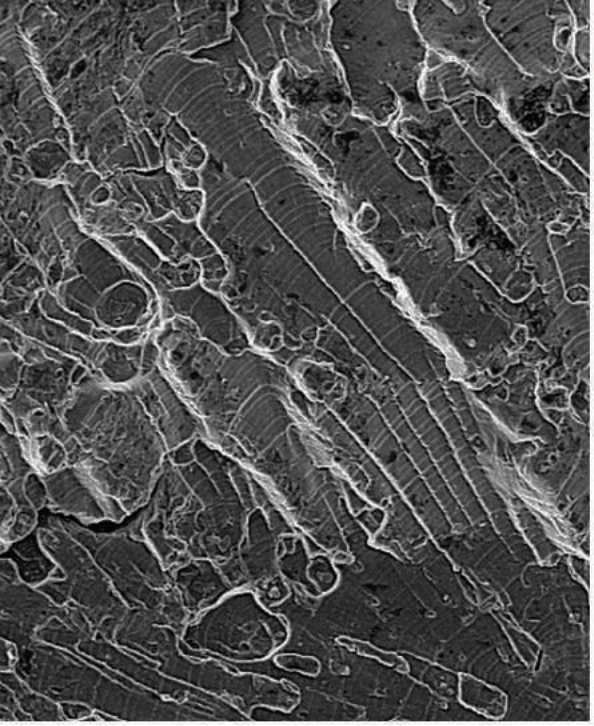
- Preparation of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) for welding and repair welding
- Optimization of parameters in welding
- Quality control of weldments (Nondestructive Testing (NDT) and Destructive Testing (DT) according to related standards)
- Analysis of weld metal and Heat Affected Zone (HAZ) to find out root cause of failures related to welding process and provide solutions to prevent such failures
- Time and cost estimation for welding projects
- Technical advice and consultancy for Brazing and Soldering
- Quality control of brazed and soldered components

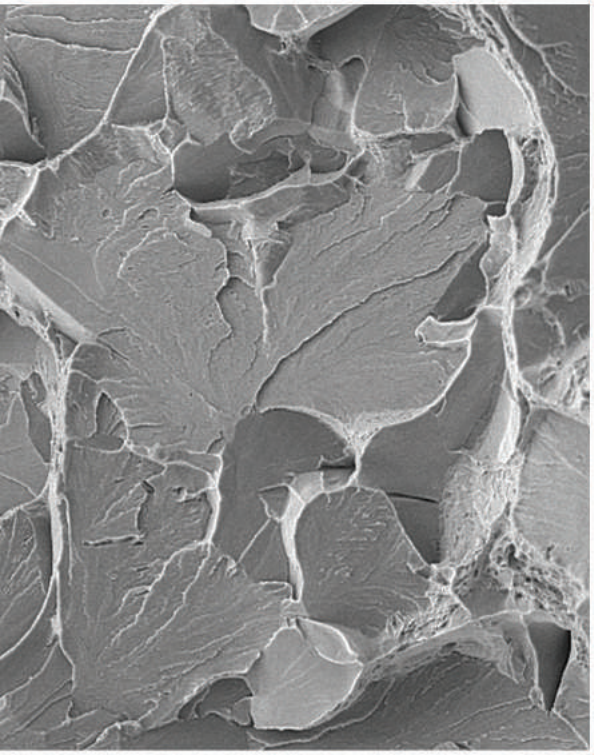
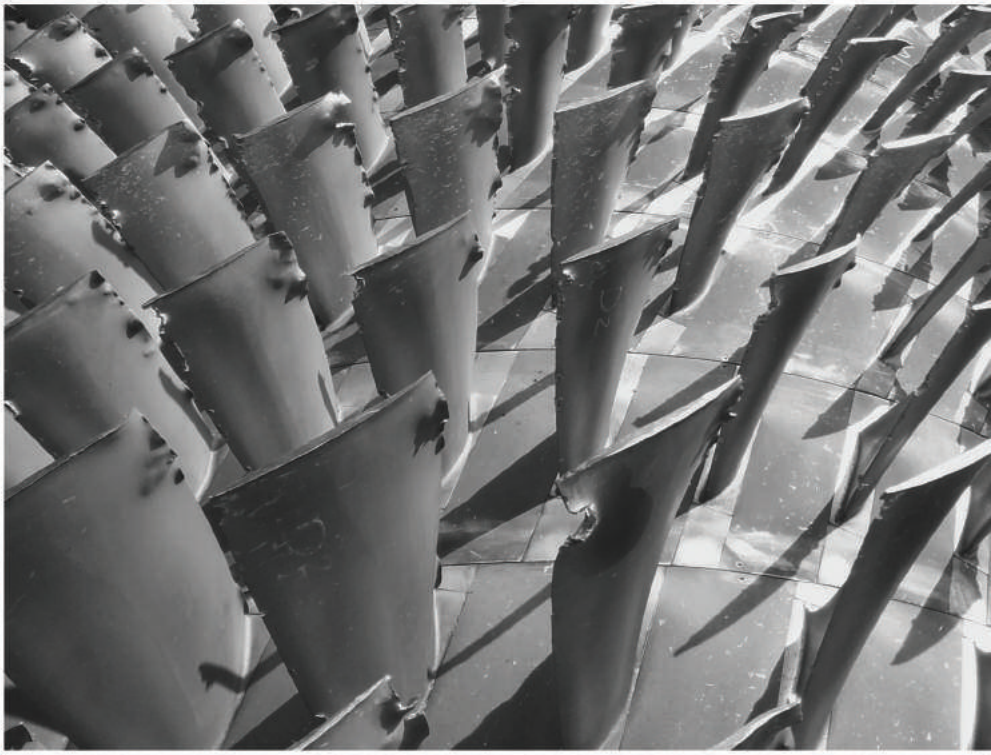
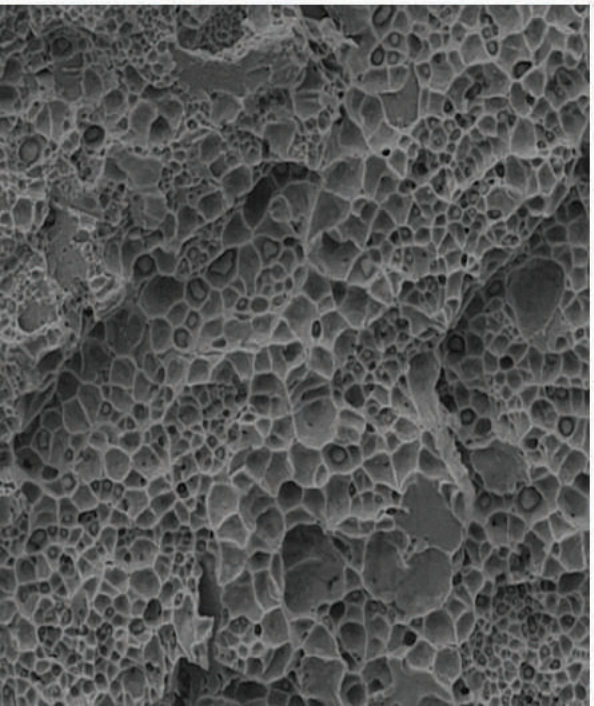
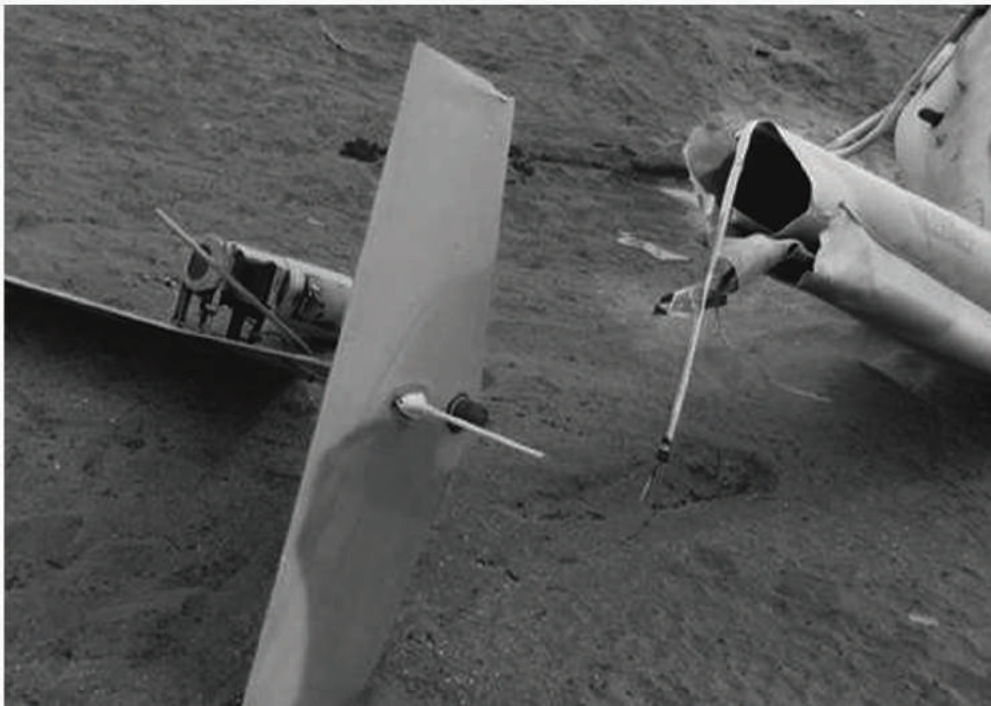
Materials Selection

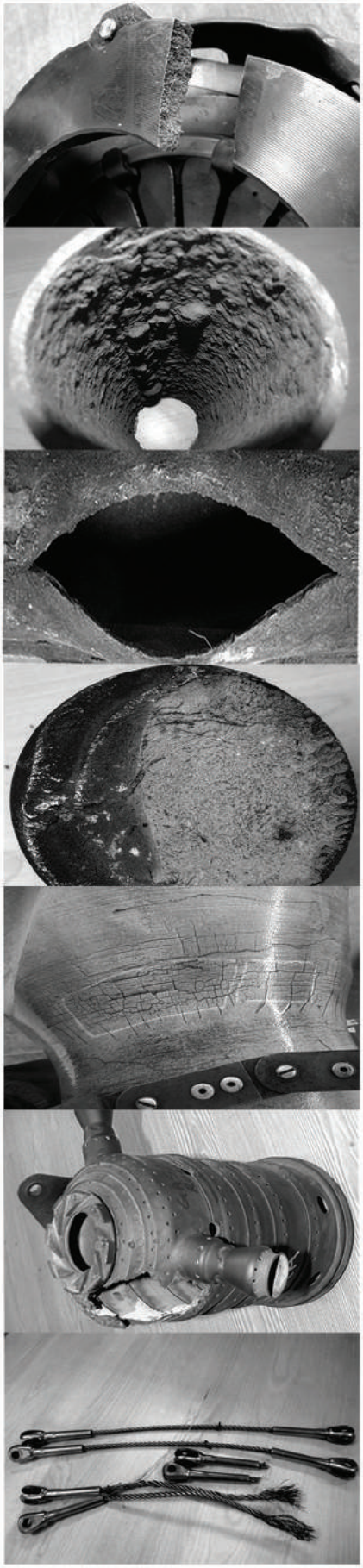


Materials selection process is characterization and optimization of engineering material properties.
In this process the proper material is selected according to defined criteria of working conditions and desired physical and mechanical properties, and then by optimizing production parameters, it is tried to obtain the most suitable properties with respect to performance, sensitivity as well as economic and the other features of sample.
Achieving this knowledge requires fully exploration of issue by means of mechanical and metallurgical approach on which high level of experience and recognition of the case study is most essential.
Materials Characterization and Selection department offers research services in the form of following patterns:

- Providing technical identity document for industrial components and engineering materials in the form of reverse engineering projects
- Consultation in selection of materials and introduction of engineering materials in order to achieve particular purposes of clients
- Performing projects on selection of materials in order to substitution of the most suitable material for components and equipment with respect to working condition, desirable metallurgical properties, and limitations to procurement of the material and production process
- Undertaking projects for specifing the manufacturing method and heat treatment cycle
- Modification of manufacturing processes, production conditions and optimization of heat treatment cycle
- Establishing National standards and revising available standards of industrially common components



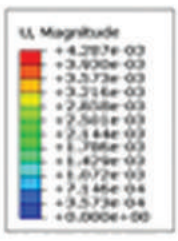


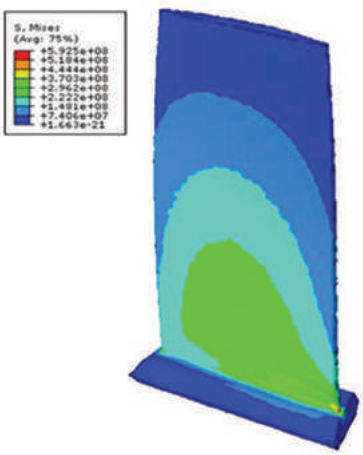
Failure Analysis

One of the most significant activities in Materials Characterization & Selection department is evaluation of troublesome failure and fracture in the industry.
Razi Metallurgical Research Center offers clients a comprehensive and practical report about effective factors in failure, failure mechanism, analysis of fracture mechanics , recommendation for preventive measures,modification of working conditions, repair the damaged componenets all in accordance with following principles:

- Study of the sample history and records, available evidence and documents, technical specifications and standards related to the samples
- Macroscopic and microscopic study of the sample and designing consequently required tests mentioned in the relevant standard
- Assessment of working conditions, effective factors in degradation and possible failure mechanism
- Study of accredited scientific references and books
- Management of information and establishment of relationship between relevant information and engineering science
- Simulation and stress analysis
- Consultations with professors, experienced and specialized consultants
- Identifying Root causes, drawing conclusions, and reporting the results

Some of the clients requesting for these research services are:
Parsian Gas Refinery, Sarkhoon and qeshm Gas Refinery, National Refinery & Distribution Oil Products, Oil Refinery of Bandar-Abbas, Petrochemical of Faravaresh- Bandar-Emam, Arvand Petrochemical, Boalisina Petrochemical, Jam Petrochemical, Khozestan Steel, Mahan Helicopter, Sapco, Saipa, Mapna group, Nikan Turbine Blade, Tubing Industries, Isfahan Casting Industry, Tehran Bureau of Standard, Justice of Tehran Province and so on.



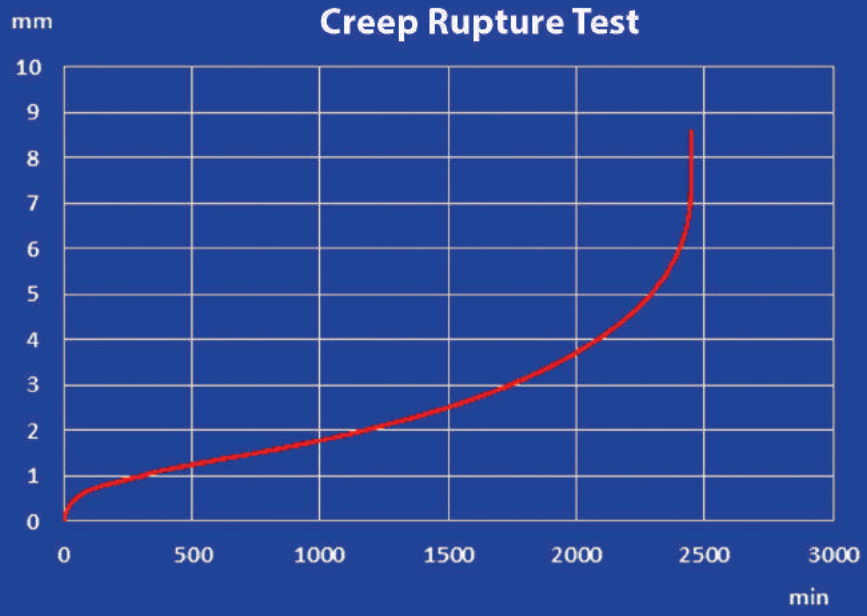


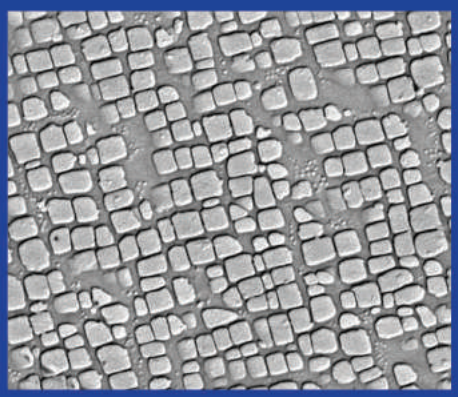
Life assessment

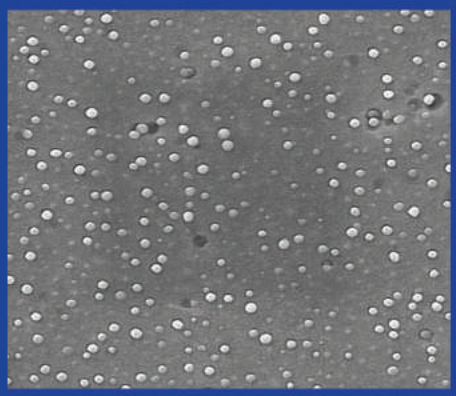
Since substantial amount of money is invested in both industrial equipment and replacement of components before retirement or failure, it is absolutely vital to prevent possible damage.
On the other hand, if the lifetime has not been assessed correctly, it can cause early replacement, and therefore additional costs.
In fact, the aim of Life assessment is not expanding life span, but maximising reliable lifetime which can be longer than that for designed one.
Razi Metallurgical research center is well qualified for consultancy and scientific services by providing remaining life assessment of useful components in different industries such as those used in petrochemical (including superheater tubes, boiler, cooling systems, heat exchangers, reformers and crackers, pressure vessels, pump components,…) as well as power plants components(including turbin blades, superalloys,…).

Some of the clients requesting for these research services are:
Refinery of Naft Shazand Arak, National Refinery & Distribution Oil Products, Oil Refinery of Bandar-Abbas, Pardis Petrochemical, Zagros Petrochemical, Fanavaran Petrochemical, Amirkabir Petrochemical, Maron Petrochemical, Petrochemical of Faravaresh-Bandar-Emam, Ahwaz Power Generation and Ramin Power Plant, Bisotoon Power Generation, Shazand Power Generation, Qom Power Generation, Gilan Power Generation, Montazer-qaem Power Generation, and so forth.

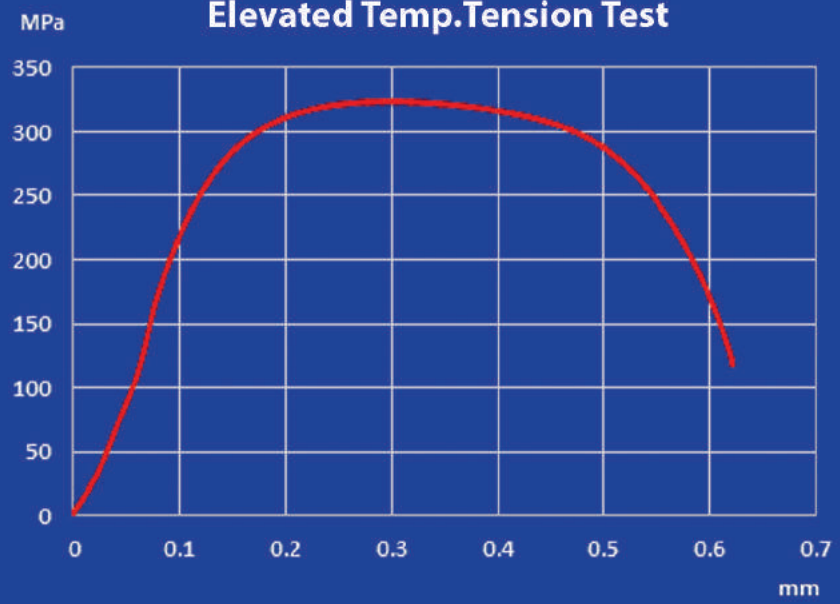
Creep Rupture Test

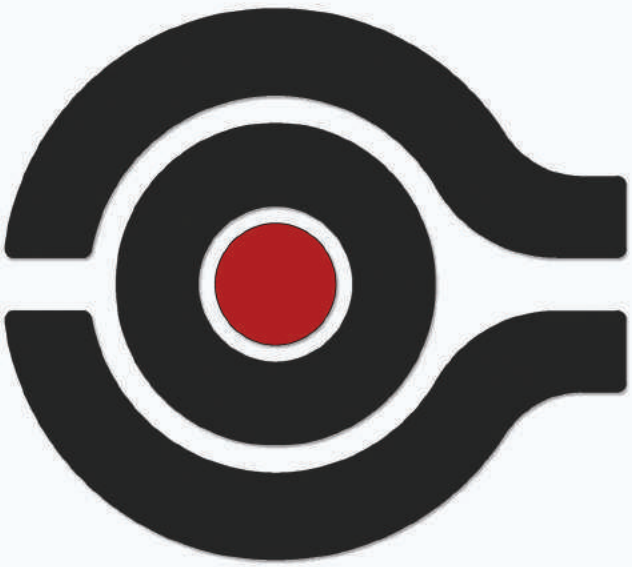






Elevated Temp.Tension Test





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Address : No.8, Fernan Street, Haj-Ghasem Asghari Blvd,

Shahre Ghods Entrance (Sorkhe Hesar), next to Pars Oil Co.,Km 21 Karaj Makhsous Road, Tehran, Iran.

P.O.Box : 37515-386

Tel : +98-21-46831570-7 & +98-21-6307 Email : info@razi-center.net

Fax : +98-21-46831597 & +98-21-46843371 Email : failure@razi-center.net

www.Razi-Center.net