CORROSION TESTING CAPABILITIES

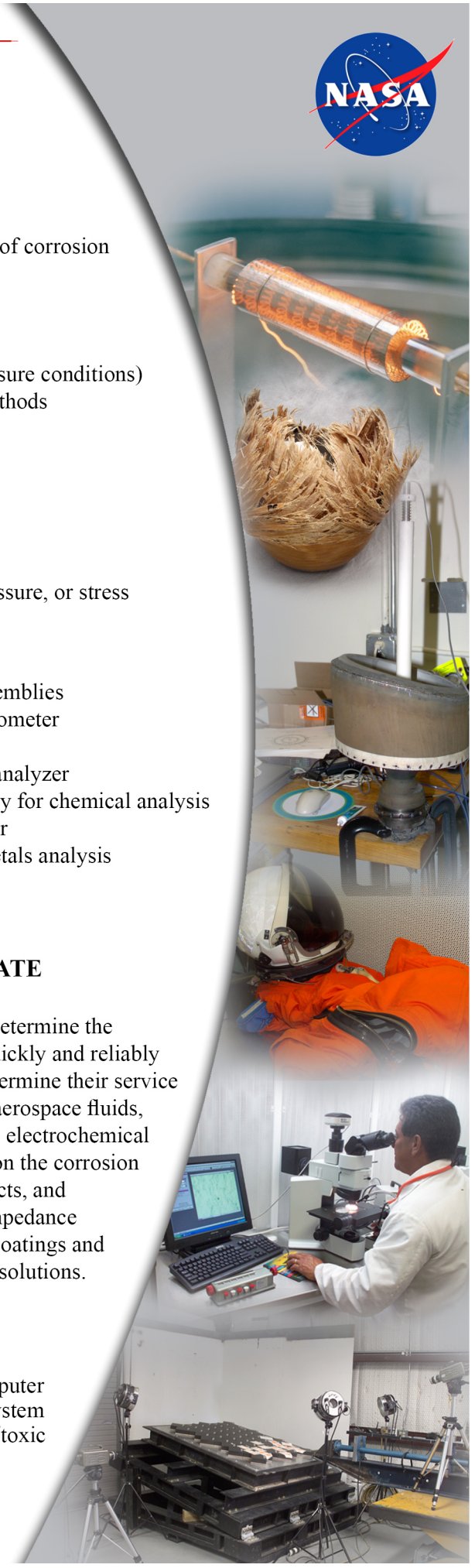
SUMMARY

White Sands Test Facility (WSTF) can provide support in the following areas of corrosion testing:

- Electrochemical corrosion testing
- Crevice and galvanic corrosion testing
- Standard testing or customized research (unique temperature and pressure conditions)
- American Society for Testing and Materials (ASTM) standard test methods
- Evaluation of coatings and alloys in liquids and vapors
- Mechanical testing
- Stress corrosion cracking, bent-beam technique, U-bend
- Fatigue and fracture studies, and slow strain rate tensile testing
- Failure analysis
- Flowing and still seawater testing
- Service environment simulation testing under severe temperature, pressure, or stress

Laboratory equipment for corrosion and failure analysis includes:

- Electrochemical system
- Acoustic emission analyzer
- Ultrasonic scanner
- IR thermographic analyzer
- X-ray radiography
- Fourier Transform - IR microscope
- Scanning electron microscope/energy analysis/Auger electron spectroscopy dispersive x-ray analysis
- Crevice forming assemblies
- Holographic interferometer
- Impact tester
- Thermogravimetric analyzer
- Electron spectroscopy for chemical analysis
- Slow strain rate tester
- ICP-MS for trace metals analysis



ELECTROCHEMICAL DETERMINATION OF CORROSION RATE

Advanced electrochemical techniques are becoming the method of choice to determine the compatibility of materials in fluids. They also serve as a mean to determine quickly and reliably the corrosion rate of materials in various media that can be extrapolated to determine their service lifetime. WSTF is involved in corrosion testing of materials in salt solutions, aerospace fluids, acids, and vapor phase environments. The combination of a direct current (dc) electrochemical technique and alternating current (ac) impedance spectroscopy provides data on the corrosion resistance of alloys, performance of corrosion inhibitors, dissimilar metal effects, and susceptibility of materials to pitting and crevice corrosion. Electrochemical impedance spectroscopy (EIS) provides key information on the stability and integrity of coatings and mechanisms of corrosion and can provide corrosion rates in low-conductivity solutions.

TEST APPARATUS, PROCEDURE, AND RESULTS

The testing is performed using a commercial electrochemical system and computer data acquisition system with a specially designed electrochemical cell. This system utilizes small samples and accommodates testing in a wide variety of reactive/toxic media.

In dc electrochemistry, a potential is applied to the material in solution, and the resulting current is measured. The current-voltage curve obtained provides information about the corrosion behavior. EIS ac experiments involve imposing a sinusoidal potential signal on test electrodes and monitoring the current through a range of frequencies. The impedance spectrum obtained provides values for polarization resistance and capacitance that can be translated to corrosion rates of metals. They can also be used to evaluate the stability and integrity of polymer coatings. Corrosion rates at different solution concentrations, temperatures, and pressures can be determined.

APPLICATIONS

Corrosion rates of materials can be determined for materials compatibility issues. Data on galvanic corrosion, hydrogen embrittlement, stress corrosion, and potential coating failure under a variety of conditions can be used to make appropriate material selection decisions.

EXPERIENCE BASE

WSTF's experience in corrosion investigation has been developed over the years on several projects. For example, EIS and dc electrochemical techniques have been utilized on major projects for the U.S. Air Force and NASA to study aviation fuel corrosion in the Advanced Cruise Missile and the Tomahawk Missile. More recently, WSTF has developed techniques to study the corrosion of aerospace materials in hydrazine, and in carbon dioxide and/or ammonium nitrate contaminated hydrazine. WSTF is also involved in developing a sensor to detect the corrosion of aerospace materials in propellant and oxidizer vapors at ambient and elevated temperatures.

CONTACT

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