List of Technologies and Industrial Applications
Southwest Research Institute
Mechanical and Materials Engineering Division

机械与材料工程分院

技术及工业应用

美国西南研究院

SwRI Mechanical & Materials Engineering in General	**西南研究院在机械与材料工程方面的研究**
• Compressor/piping design: API or client specifications, new and retrofit designs • Plant engineering services: rapid response, trouble shooting, operational improvements • Gas flow measurement: meter calibration, station design • Safety valve testing (production, pipeline, and refinery): to API/ISO and client specifications • Subsea wellhead system testing: ocean pressures & temperatures, API and client specifications • Materials evaluation: fatigue and fracture in hazardous environments, corrosion • Turbomachinery design & testing: rotordynamics, performance, blade life • Product development/testing: structural/fluid flow analysis, mechanical design, environmental testing • Failure analysis: root cause determination, rapid response • Ballistic design and testing: blast-resistant structures, vehicle protective armorment, aircraft bird strike testing • Aircraft structural testing: FAA certification, life extension, fuel sloshing • Analytical & materials characterization services: infrared spectroscopy (TFIR), thermal analysis, atomic force microscopy, scanning Kelvin probe, and calorimetry, Raman spectroscopic analysis • Modeling and simulation services: computational fluid dynamics, hydrocode simulation, hazard and consequence, corrosion, molecular dynamics modeling • Software products for structural integrity/life prediction: probabilistic analysis, uncertainty quantifications, reliability	• 压缩机与管线设计：美国管道研究院或用户设计标准，新设计或改建 • 工业设施工程服务：迅速排除故障，改进运行可靠性 • 气体流量测量：流量计标定，油气站场设计 • 阀门安全测试（生产，管道，炼油厂）：美国管道研究院以及国际标准，用户标准 • 海底钻井系统试验：海洋压力以及温度，美国管道研究院，用户标准 • 材料评估：有害环境下的疲劳与断裂，腐蚀 • 涡轮机的设计与实验：旋转动力学，特性分析与测试，叶片寿命 • 产品设计与实验：结构力学与流体分析，机械设计，环境实验 • 失效分析：迅速查找确定原因 • 弹道学设计与实验：抗爆炸结构，车辆防爆保护，飞鸟撞击飞机试验 • 飞机结构试验：美国航空管理局标准试验，延长寿命，燃料晃动 • 材料分析与表征服务：红外频谱仪，热分析，原子力显微分析，凯尔文扫描探测仪与热量仪，拉曼谱分析 • 建模与模拟：计算流体动力学，水力学模拟，危险性与可能结果分析，腐蚀、分子动力学建模与分析 • 用于结构完整性与寿命预测的计算机软件：概率分析，不确定性的定量分析，可靠性分析
Mechanical and Materials Engineering Applications	**机械与材料工程的应用领域**
• Oil and gas exploration and production: drilling hydraulics, downhole equipment, flow assurance, materials selection/qualification/testing related to tubulars, risers, and other components • Oil and gas transportation: metering/gas analysis research, machinery design/evaluation, sensors, corrosion modeling, pipeline integrity assessment, mechanical damage assessment • Aerospace and transportation: fatigue evaluation, remaining life assessment, sensors, coatings • Alternative energy generation: hydrogen storage/transportation, fuel cells, nuclear reactor material performance evaluation, turbine materials assessments • Chemical process industries: corrosion monitoring tools, materials selection	• 油气勘探与开发：钻井用液压系统，井下设备，用于管道的流体保障，用于管柱的提升装置分析以及其它部件的材料选择，检验与测试 • 油气输送：天然气计量研究，机械设备的设计与评估，传感器，腐蚀模型，管道完整性与可靠性评价，机械损伤评价。 • 航空与运输：疲劳分析，残余寿命分析，传感器，涂层 • 新能源的生产：氢储存与传输，燃料电池，核反应材料的评估，涡轮机材料评估 • 化学处理工业：腐蚀监测工具，材料选择
Specific Industries	**具体工业对象**
Steam and land-based gas turbine/power industry	**能源工业，汽轮机以及陆地应用的透平机组**
• Failure analysis • Component life prediction/prevention of catastrophic failure	• 失效分析

• Thermal barrier coatings • Erosion-resistant coatings • Life extension methods/minimization of replacement cost and down time • Analysis of coating failure under simulated service conditions • Vibration-induced damage/damage mitigation	• 工件寿命预测/重大事故预防 • 隔热涂层 • 抗溅蚀涂层 • 延长寿命方法/降低维修成本和停机维修时间 • 模拟实际运行时的涂层损伤失效分析 • 振动引起的损伤/降低损伤
Aircraft gas turbines	**航空工业，飞机发动机**
• Failure analysis • Life estimation/modeling/software • Life extension beyond manufacturer limits • Inspection methods/frequency of inspection • Probabilistic aspects of anomalous material failure/prevention of catastrophic failure • Erosion-resistant coatings	• 失效分析 • 寿命预测/模型/软件 • 生产厂家预定寿命以外的延长 • 检测方法/检测周期 • 材料非正常失效概率统计分析/重大事故的预防 • 抗溅蚀涂层
Hydrogen transmission and storage industry	**能源工业，氢气运输以及储存**
• Measurement of solid-state hydrogen storage capacity • Hydrogen gas metering/measurement technology • Hydrogen transmission line safety • Catalyzation of carbon nanotubes for hydrogen storage • Large scaled, low Pt loading catalyzation of membranes	• 氢气储存容量测量 • 氢气计量/测量技术 • 氢气输送管道安全分析 • 储存氢气的碳纳米管的催化作用 • 燃料电池的质子交换膜的低铂金，大批量催化
Offshore oil and gas development	**能源工业，滩海石油以及天然气的开发**
• Testing of drilling materials and joining methods under realistic environmental conditions (sub-ocean floor temperatures and environments, such as brine/H_2S/CO_2) • Life analysis/fatigue/fracture/intrinsic flaw distributions/environment/ temperature/probabilistics • Testing of full size structures/realistic sour-gas environments • Reliability experiments on welded reeled risers • Software tools/qualification of reeling installations • Assessment of reeled riser plastic flow/remaining fatigue life/seawater or salt environment • Multi-phase flow; flow assurance, downhole equipment, metering, pumping and instrumentation • Acceptance criteria for defect inspection in welded reeled risers • Reliability assessment of gas/liquid transmission and distribution lines/corrosion • *In situ* transmission line corrosion sensors • Corrosion mitigation in transmission lines	• 钻井材料和联接方式在实际环境下的实验（海床温度和环境，包括盐水，H_2S 以及 CO_2） • 寿命分析/疲劳/断裂/内部损伤分布/环境/温度/概率统计分析 • 全尺寸试验/实际酸气环境试验 • 卷扬升降器焊口的可靠性试验 • 软件工具/卷扬机的安装 • 卷扬升降器塑性形变的评价/残余疲劳寿命/海水及盐水环境 • 多相流，流体安全保障，井下设备，流量计量，泵和仪器仪表 • 卷扬升降器焊口的缺欠检查和验收原则 • 气体、液体输送管道及分输管道的可靠性评价/腐蚀 • 即时管线腐蚀传感器 • 管道防腐技术
Automotive industry	**汽车工业**
• Hard coatings for cutting tools (gear cutters, milling tools, etc.) for increased life and reduced cost • Hard coatings for punches and dies, stamping dies, cast molds, and foundry • Components (gears, pistons, piston rings, connecting rod, wrist pins, tappets, valves fuel injectors, etc.) hardening by high speed nitriding or hard coatings for improved performance • Coating and paint degradation sensor	• 用于刀具寿命延长和降低成本的等离子硬膜涂层（齿轮铣刀，铣刀，车刀等等） • 用于刀具寿命延长和降低成本的各种冲压磨具，铸造磨具的硬膜涂层 • 汽车部件的高速渗氮，硬膜涂层（齿轮，活塞，连杆，活塞销，阀门，销柱的等等）

	• 涂层及漆膜破损程度的传感器
Machine tool, bearing, gear, textile industries	**机床，轴承，齿轮，以及纺织机械工业**
• Hard coatings for cutting tools (gear cutters, milling tools, lathe cutters, etc.) • Hard coatings for punches and dies, stamping dies, cast molds, shuttles, guides, wheels • Components (gears and bearings) hardening by high speed nitriding or hard coatings for improved performance	• 切削工具的硬膜涂层（齿轮铣刀，铣刀，车刀等等 • 各种冲压磨具，铸造磨具，梭子，导轨，轮子的硬膜涂层 • 部件（齿轮和轴承）的高速渗氮以及硬膜涂层
Chemical and Refinery Industry	**化工工业**
• Sensors for increased safety • Modeling of corrosion in complex environments (OLI CSP) • Corrosion monitoring using MAS probe • Modeling for structural safety (NESSUS) • Fracture mechanical testing in toxic environments • Component coatings for increased corrosion resistance • Corrosion research in non-aqueous environments	• 用于增加安全的传感器 • 复杂环境的腐蚀计算机模型（OLI CSP) • 腐蚀监视探头（MAS） • 用于结构安全的计算机模型（NESSUS) • 有毒气体环境中断裂力学实验 • 部件的防腐蚀涂层 • 非水环境的腐蚀研究
Biomaterials	**生物材料工业**
• Biocompatible coatings • Treatments of orthopedic devices for prolonged life • Radioactive treatments for stents, wound dressing for fast cure • Radioactive tracer measurement of wear debris volume • ISO testing	• 生物材料涂层 • 人工骨关节材料的寿命延长 • 血管植入弹簧的放射处理减少感染加速愈合 • 微量放射元素测量磨损量 • 试验（国际标准）

更多的信息请您联络美国西南研究院北京代表处李金武，北京朝阳区东三环北路 8 号亮马河大厦 1 座 1303 室，电子邮箱：jinwu.li@swri.org 手机：13911774667,电话：010-65906391-805,传真：010-65906392