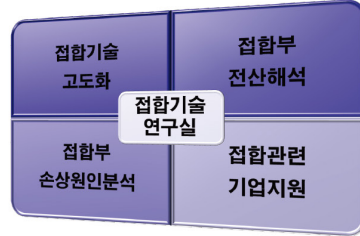


💡 접합기술연구실 개요

소재/부품/설비의 안전성 및 신뢰성을 확보하기 위한현장 맞춤형 접합기술에 관한 연구 및 평가, 기술지원

- 발전산업용 보수용접기술 개발 및 적합성 평가
- 용접부 잔류응력/변형/미세조직 전산해석 및 실증
- 용접부 건전성평가 및 결함수명평가
- 중소중견기업 용접관련 기술지원 및 교육



🏆 우수성

표준용접절차시방서(SWPS) 개발

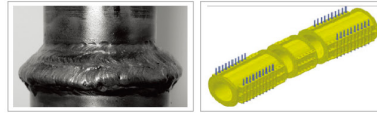
- 과제 소개
 - 국내 원전 기술기증 및 발전사업자 추가 요구사항을 반영한 한국형 SWPS 개발 및 제도화 추진으로 원전 용접부의 안전성 제고 및 원전산업 활성화에 기여



- 공동수행기관 : S사, H사, D협회

안전등급 소구경배관 용접부 건전성 실증

- 과제 개요
 - 국내 원자력발전소의 가동연수 증가에 따른 경년열화로소구경배관 용접부의 손상 가능성 증가
 - 소구경배관 소켓용접부의 진동 피로 파손에 대한 분석 및 긴급보수기술 개발 필요
 - 소켓용접부 오버레이 기술 개발, 클램핑 개발 진행 중

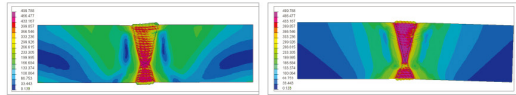


- 공동수행기관 : S사, H사, D협회

용접해석 지원

- 지원 배경
 - 용접해석은 신규공정 도입 및 파손분석에 유용한 도구
 - 중소/중견기업에 용접해석 지원을 통하여 개발비용 절감 및 제품신뢰성 향상 효과를 획득

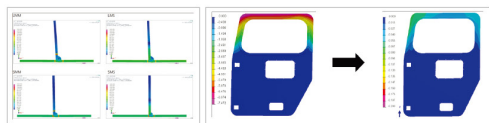
용접개선 형상에 따른 잔류응력 예측



Double U 양면개선

X 양면개선

용접변형을 최소화할 수 있는 용접공정 모색



용접조건별 잔류응력 분포

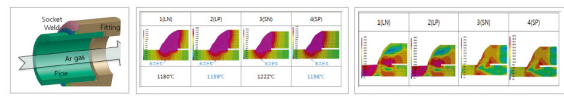
최초 : 7.4mm 변형

개선 : 0.7mm 변형

기타 용접기술지원 수행내역

- ① 부품소재기반 기업의 용접기술지원
 - 용접봉 산선을 변화에 따른 용접봉 물성 평가
 - 스테인리스강 와이어 무산화 접합기술 개발
 - 용접봉 열처리 조건에 따른 오스테나이트 결정입도 변화
 - 기업체 기술연구소 현장지도 및 교육
- ② 부품조립기반 기업의 용접기술지원
 - 스테인리스 소결체/스테인리스강 용접부 결함 원인 분석
 - 크레인 Lifting Jig 제작을 위한 WPS/PQR 제작 지원
- ③ 배관, 구조물, 용접부 건전성평가 및 결함수명평가

용접해석을 이용한 소켓용접부 건전성 평가



용접조건별 잔류응력 분포

최고온도분포 예측

잔류응력 예측

📅 향후 계획

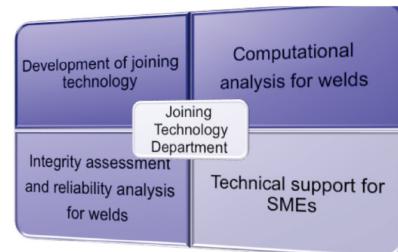
- 3D 프린팅 기법으로 제조된 금속재료의 접합/보수기술 연구
- 용접부 잔류응력 / 변형 / 미세조직 전산해석 및 실증
- 용접재료 고도화 연구

Joining Technology Department

Key responsibilities

Research, evaluation and technical support regarding site customizable joining technology to ensure the safety and reliability of materials, parts and facilities, including:

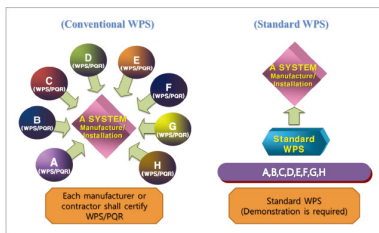
- Development and evaluation of repair welding technology for power plant
- Finite elements analysis for residual stress, deformation and microstructure of welds
- Integrity assessment and reliability analysis for piping, structure and welds
- Technical support and training of welding technology to small and medium-sized enterprises



Major activities and technical support

Development of standard welding procedure specifications (SWPS)

- Overview : Developing SWPSs based on the technical standards for nuclear power plants and the needs of utilities to ensure safety in welding for nuclear power plants and help growth of the nuclear industry

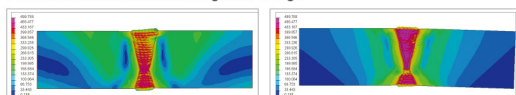


Partners: Sungil SIM, KEPCO KPS, Korea Electricity Association

Support for weld analysis

- Background
 - Weld analysis is useful for introduction of new process and fracture analysis
 - Helping SMEs with weld analysis can result in their cost saving and higher product reliability

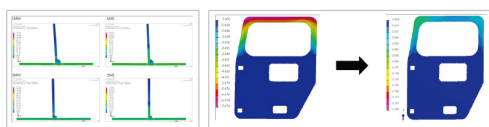
Prediction of residual stress for groove design



Double U groove

Double X groove

Welding process development for minimize weld deformation



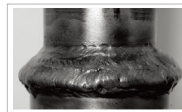
Distribution of residual stress depending on welding conditions

Before: 7.4 mm deformed

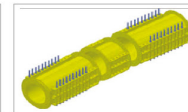
After: 0.7 mm deformed

Structural integrity and reliability for small bore pipe welds

- Overview
 - Increasing vibration fatigue problems of power plant small bore piping systems
 - The frequent fatigue failures of small bore piping connections result in degraded plant systems and unscheduled plant downtime
 - Conducting a number of tests of socket welds for the understanding of this phenomenon
 - Developing the socket weld overlay and mechanical clamping device for on-line repair to contribute to reliability of nuclear power plants



Weld overlay

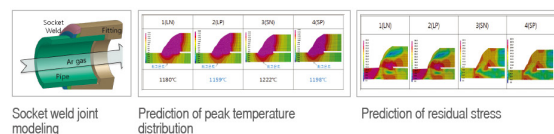


Mechanical clamping

Other activities

- Technical support for companies in material and component industries
 - Evaluation of effect of drawing rate on mechanical properties of welding material
 - Non-oxidation joining technology of stainless steel wire
 - Evaluation of heat treatment effect for grain size of austenitic welding material
 - Training and education for researchers in company's research institute
- Technical support for companies in part assembly industries
 - Failure analysis of welded joints of sintered stainless steel
 - Development of WPS/PQR for manufacturing of crane lifting jigs
- Integrity assessment and reliability analysis for piping, structure and weldment

Evaluation of the soundness of socket weld joints through weld analysis



Socket weld joint modeling

Prediction of peak temperature distribution

Prediction of residual stress

What's up next?

- Development of welding and repair technology for metal 3D printed item
- Computational analysis for residual stress, deformation, microstructure for welds
- Development of advanced welding materials