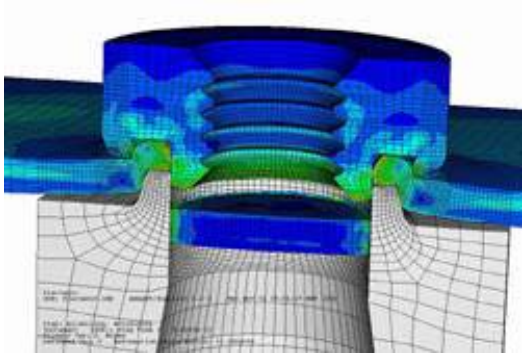
This is KIMAB

- The leading European Industry Research Institute in Corrosion and Metals.
- 140 staff in the Institute. A third have undergone research training and obtained licentiates or doctorates.
- Subsidiary in France (Institute de la Corrosion)
- Quality certification to ISO 9001.



Research efforts 2006

Member programmes	30 %
Industry assignments	38 %
EU-projects	16 %
National research programme	16 %

Business areas

Materials and Process Development

Materials Applications

Corrosion

Materials and Process Development

Alloy Design	CCT, Computational support to product- and process development, Alloy development, Powder materials
High temperature	Developments of qualities and productivity in casting and solidification, Materials processing of hot workability
Cold processes	Materials processing for cold forming, On line NDT Structural Monitoring, Annealing
Surface technology	Optimization of surface treatment, Functional surface coating, Local heat and surface treatment technology
Metallography	Modelling of microstructural changes during hot working, Microstructure development
Materials analysis/ assignments	CRM, Bulk analysis, Micro analysis, Surface characterisation, Microstructure development , Education

Materials Applications

Fatigue and heat treatment
- Sheet structures
- Machine components

Sheet technology
- Sheet fomability
- Forming technologies
- Mechanical joining

Machining
- Machinability
- Temperature measurement
- Load measurement

High temperature materials
- Creep properties
- LCF and TMF properties

Numerical modelling
- Constitutive models
- Simulation of manufacturing processes

Joining Technology Centre
- Welding processes (Resistance, MIG/MAG, FSW, Laser, Plasma, Laser-hybrid, SAW, MPW)
- NDT

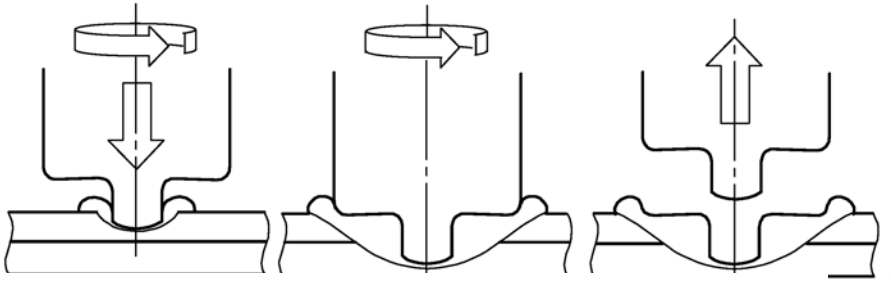
Corrosion

Metallic Materials	Materials development, Materials selection, Electrochemistry, Corrosion processes in liquids, Computer modelling
Polymeric Materials	Materials development, Materials selection, controls, Field exposures, inspections
Industrial processes	Materials selection, Plant tests, Autoclave tests, Corrosion protection
Infrastructure	Corrosion in soil, concrete and atmosphere, Cathodic protection, Stray currents, Protective coatings corrosion, Protection painting
Consultation/testing	Investigations, Inspections, Failure investigations, Advisory service, Field Stations, Standardisation, Accelerated testing
IC (Brest, France)	Marine corrosion, Coil coating, Testing, Investigations

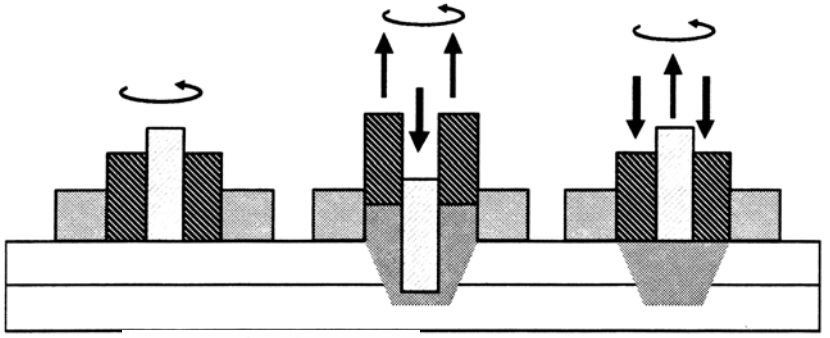
FSW research projects at the Joining Technology Center

- **Joining of aluminium to steel**
- **Mixed aluminium material joint combinations**
- **Friction Stir Spot Welding (FSSW)**

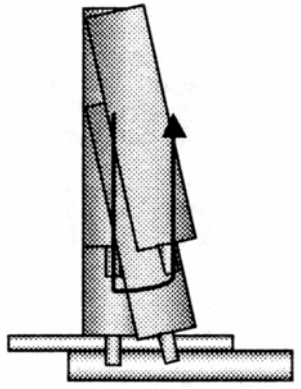
Friction Stir Spot Welding (FSSW): 3 olika metoder



”Plunge method”

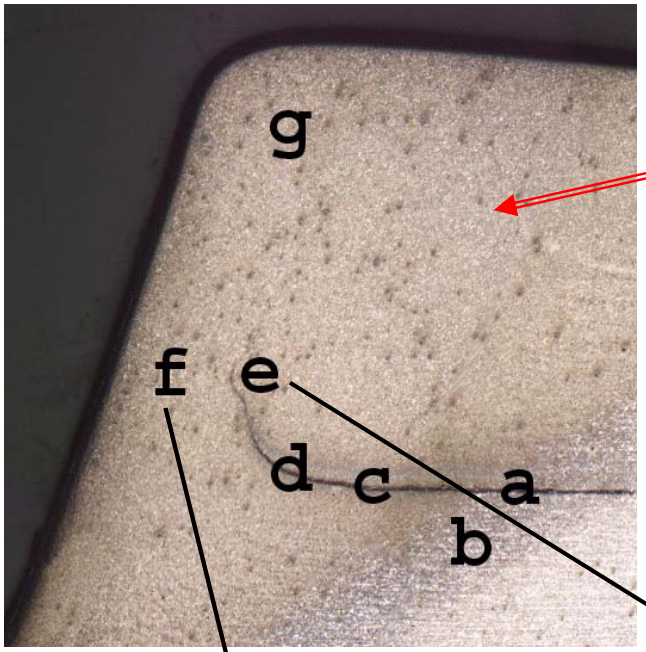


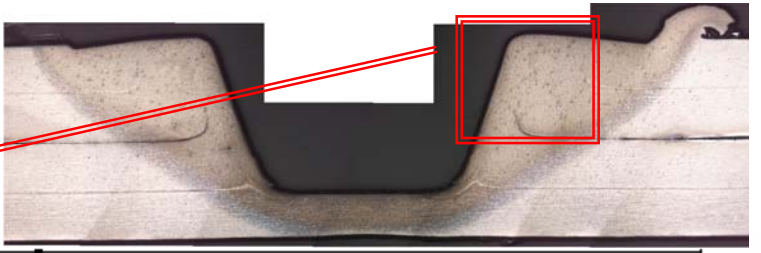
”Refill method”



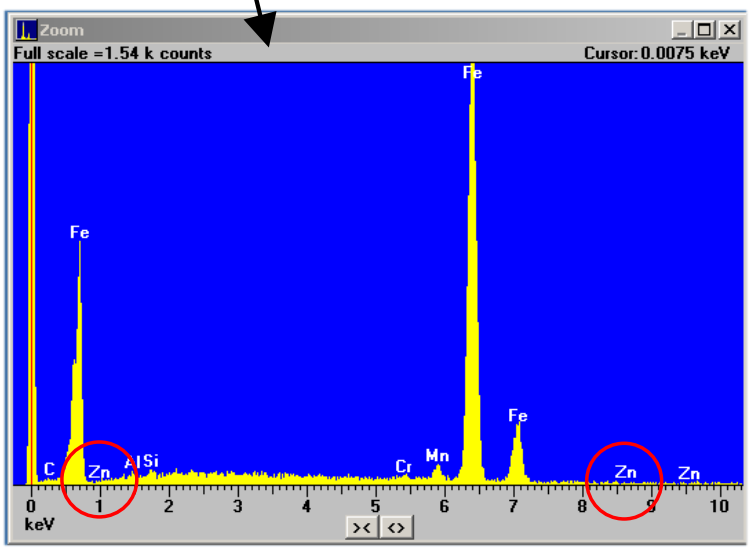
”Swing method”

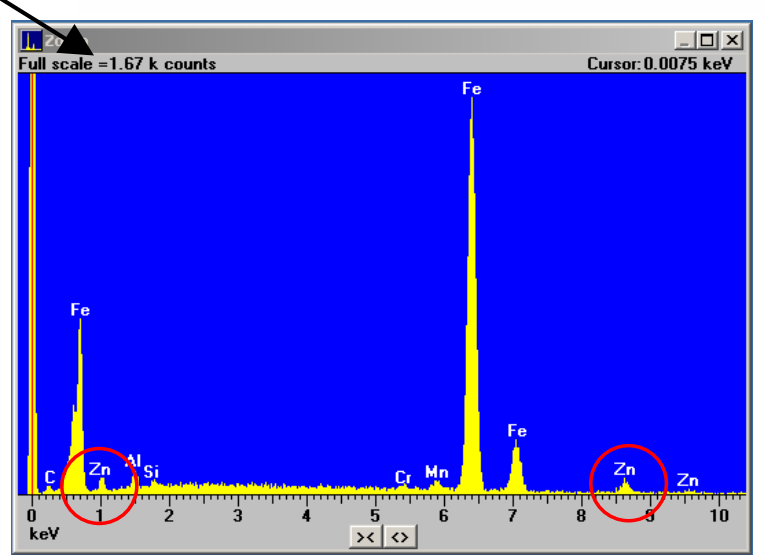
FSSW tool made of polycrystalline cubic boron nitride (PCBN)





wt-%	Position						
	a	b	c	d	e	f	g
Zn	11	-	12.3	15.4	5.7	-	-
Al	8.5	-	3	5.8	3.2	-	-
Fe	78.5	98.5	82	73	88.5	95.6	96
Si	1.3	-	0.5	3.6	0.7	1	0.9
Mn	-	rest	1.4	1.5	1.5	2.5	2
Cr	0.3	-	0.5	0.5	-	0.4	0.6
Mag.x	3000	3000	3000	1750	3000	1000	1000





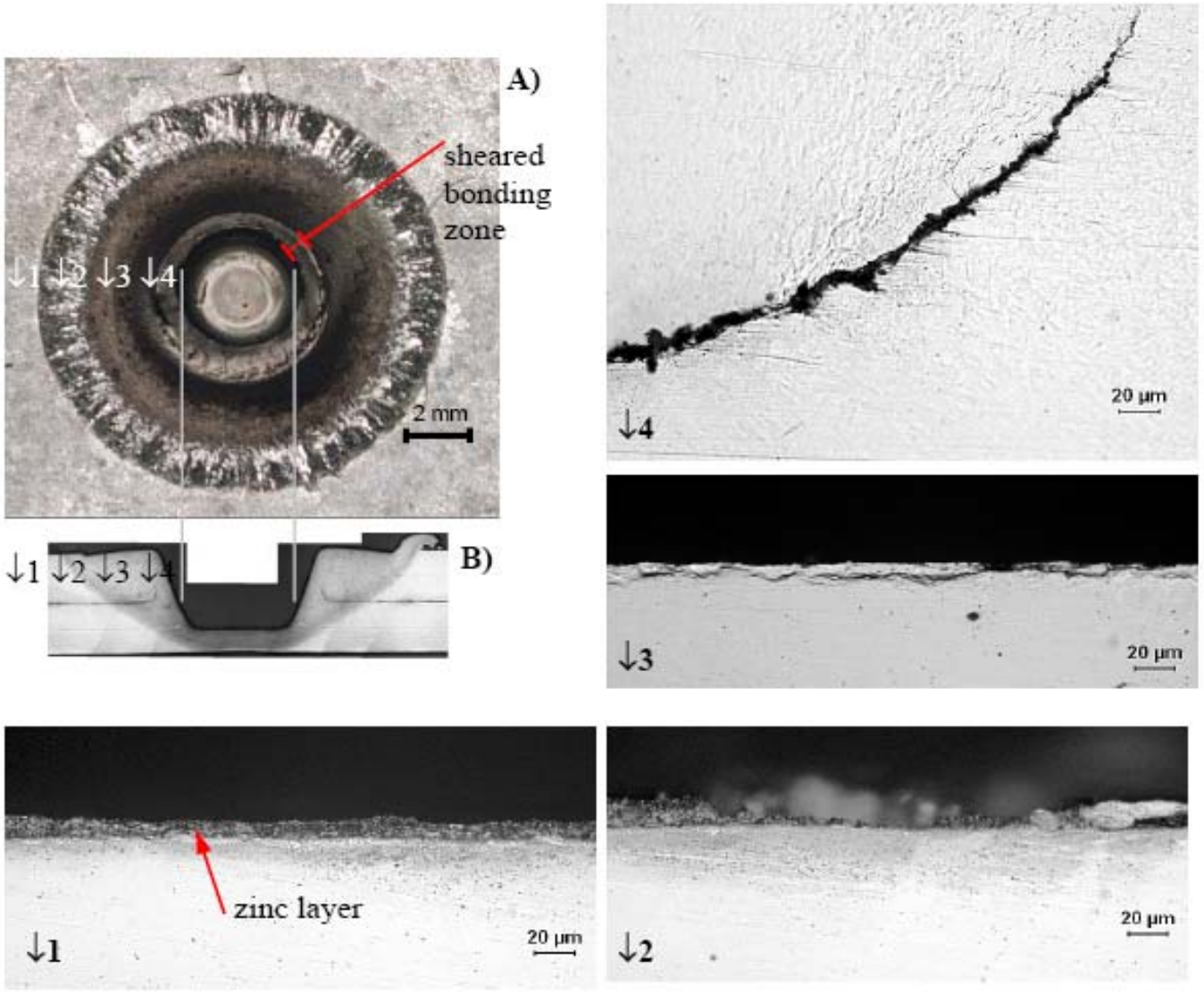
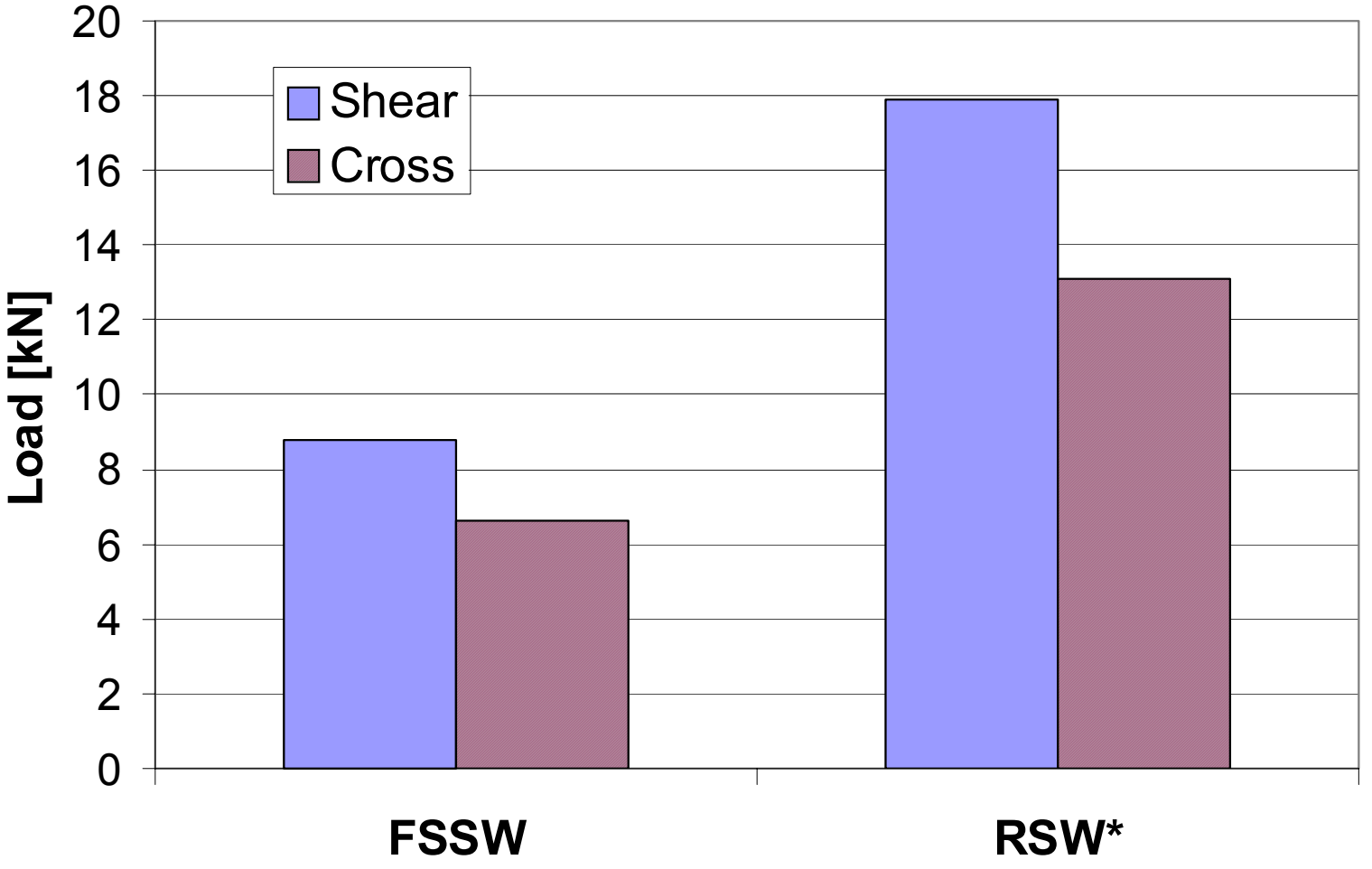


Figure 6. Fracture appearance (A) after shear-tensile testing and cross-section (B) of a FSSW-joint in 1.5 mm Dogal 600 DP. The numbered arrows (↓1 to ↓4) indicate the position of the micrographs.

Dogal 600 DP t=1.5+1.5mm



Aluminium to steel

We want to joint the materials and at the same time avoiding mixing them !

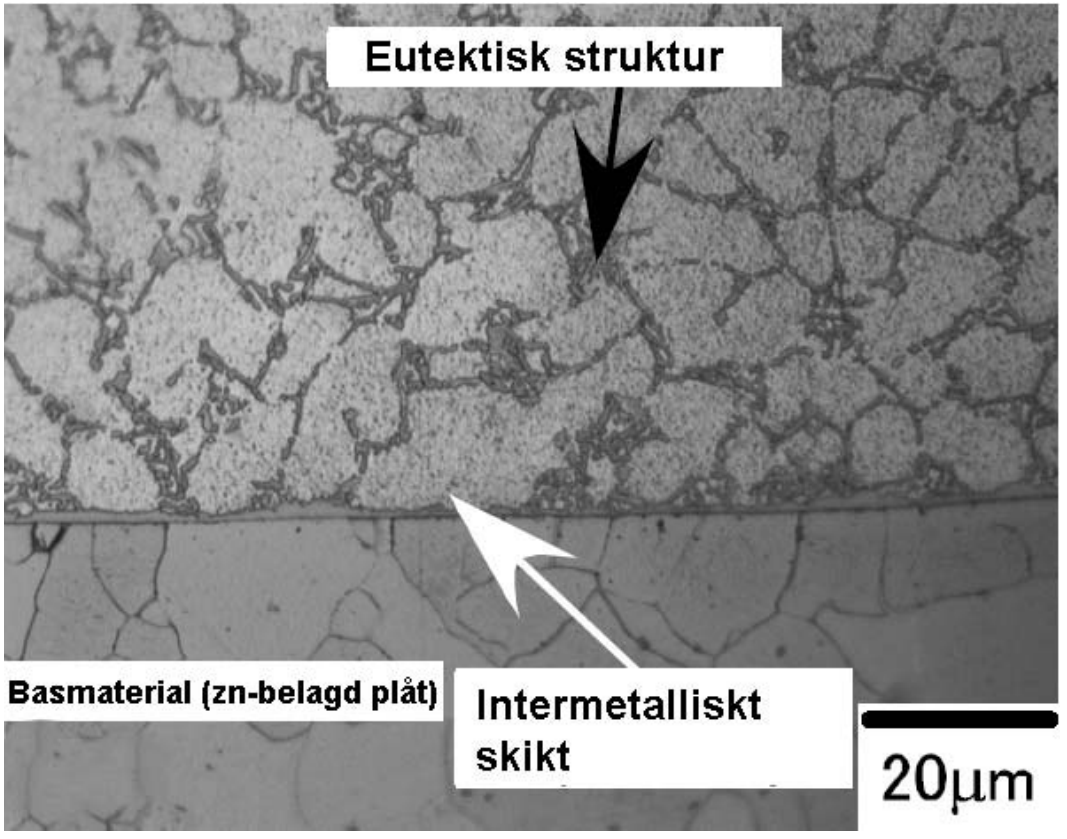
”Common” welding impossible

- FSW
- Laser-brazing
- MIG-brazing

Intermetallic phases

Intermetallic Phase	Al-content [at-%]	Micro hardness [Hv]
Fe_3Al	25	250-350
FeAl	50	400-520
Fe_2Al_7	63	650-680
$FeAl_2$	66-67	1,000-1,050
Fe_2Al_5	69.7-73.2	1,000-1,1000
$FeAl_3$	74-76	820-980

Aluminium to steel

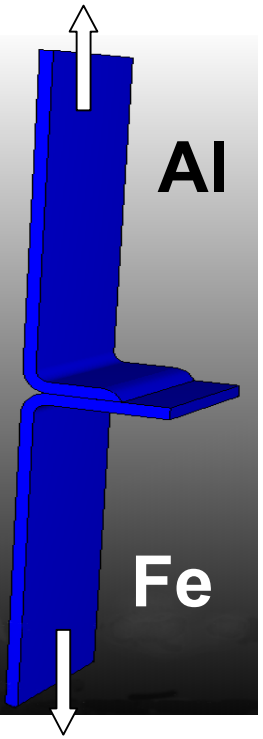


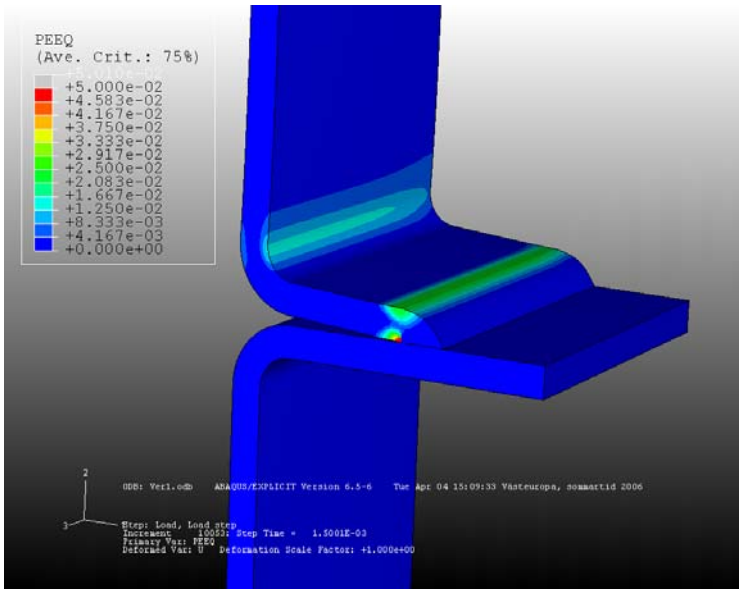
The integrity of the joint is dependent on the thickness of the intermetallic layer.

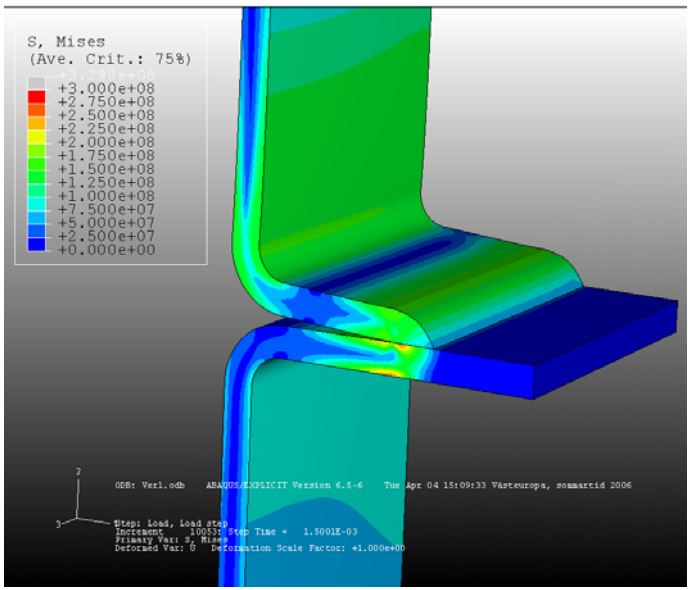
Aluminium to steel: peel loading

strain

tension





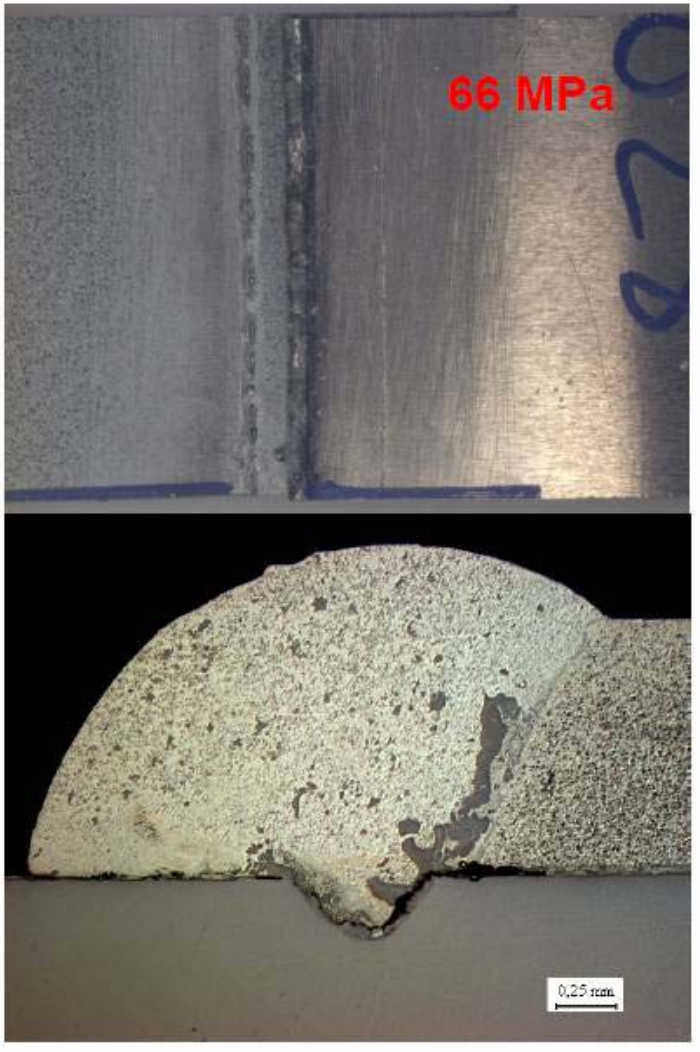


Strain and tension distribution at 5% local strain

Aluminium to steel: Laser brazing

Filler: ZnAl2 (flux12%)

[Shear strength]



Aluminium to steel: MIG-brazing

MIG-brazing

- **AA6063 / Dogal 260 RPX**
- **Filler ZnAl2**
- **High shear strength…**

…but low(?) peel strength

Services

- ➔ Contract research
- ➔ Mechanical testing
- ➔ Corrosion testing
- ➔ Metallographic investigations
- ➔ Reference material
- ➔ Manufacturing of alloys
- ➔ Damage investigations
- ➔ Education
- ➔ Consulting
- ➔ Library service