



Bonding in Karlsruhe



H.J.Simonis

F.Roederer, T.Barvich

Wire-Pulltest before and after thermal cycling

Information from the Bonder

Online-Indicator for “good” bonds



Base-material: Alu on Silicon
(teststructures from CDF)

Wire: 25 μm Alu

Bond-parameters under study:

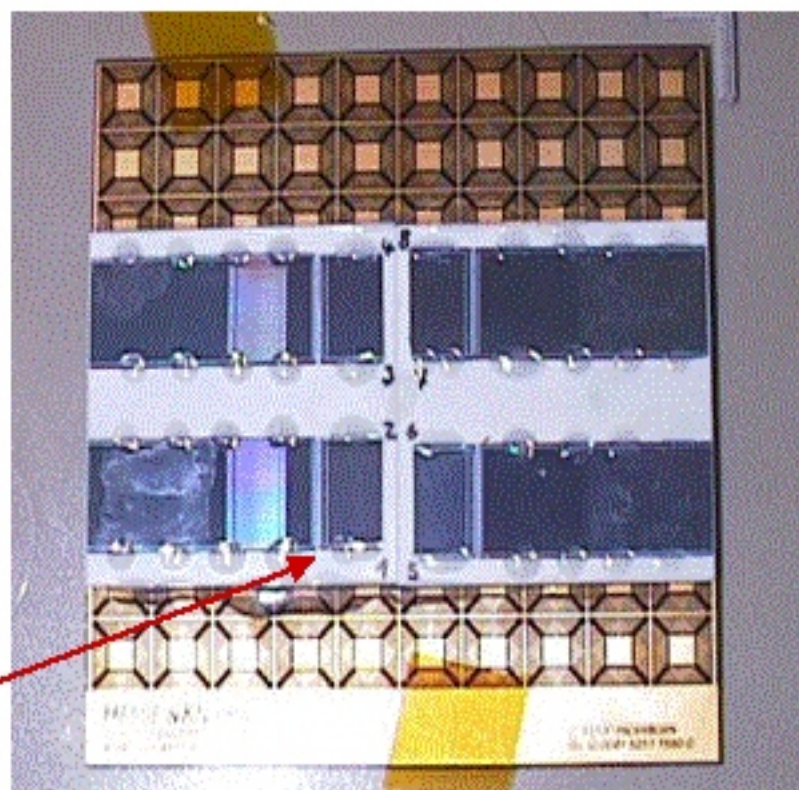
- bondforce
- ultrasonic-power
- max. deformation

2 batches with 8 different
Parameter-sets, **20 - 30 Bonds** per set
(in total 440 bonds)

One batch was **temperatur-cycled**:

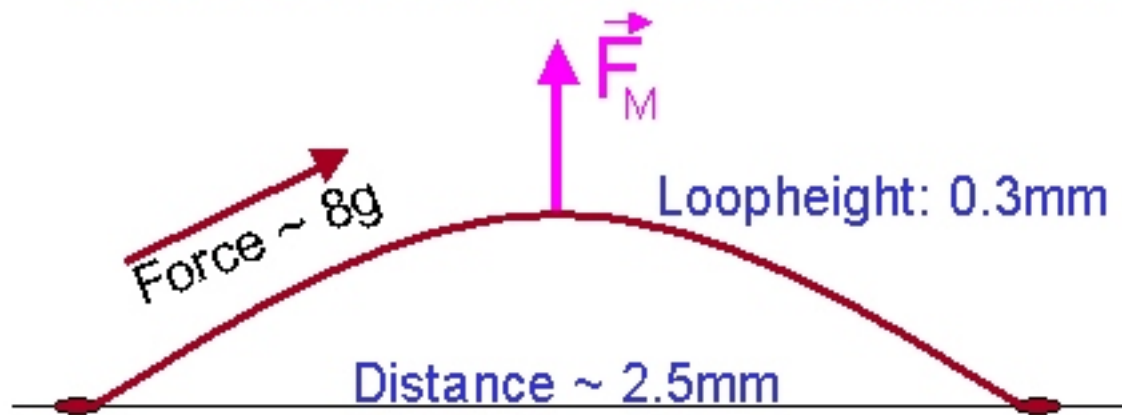
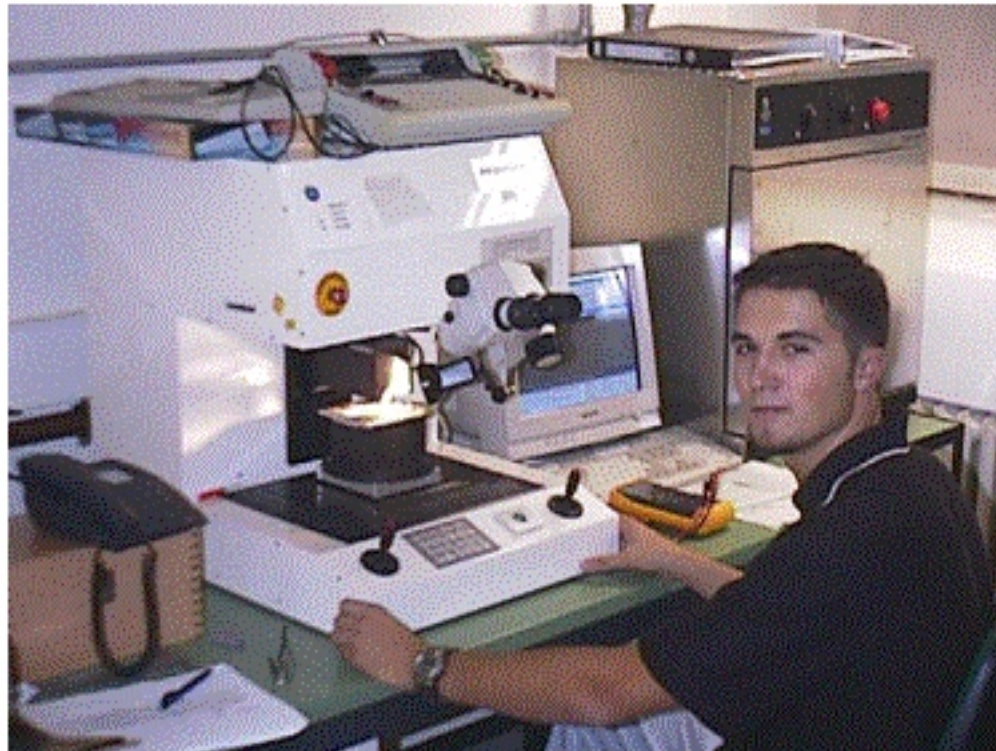
Range -40 to 40 deg;

~ 10 cycles, half an hour each

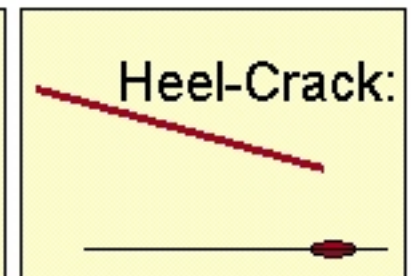
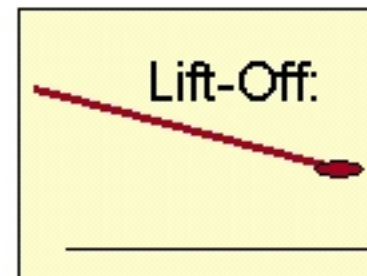




Pulltester at Forschungszentrum Karlsruhe (FZK)



3 possible damages:



(less probable: wire-break)

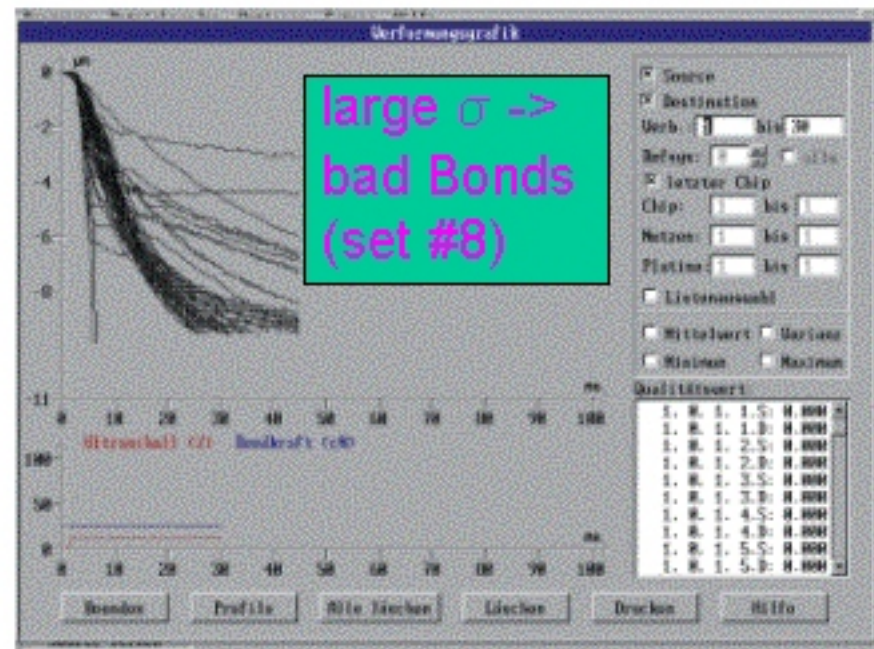
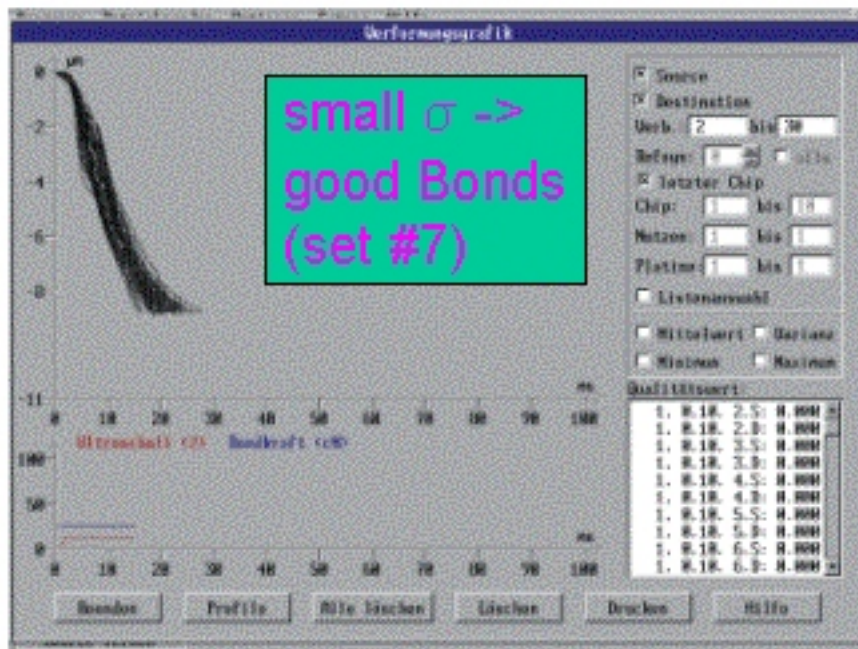


Information obtained from the Bonder



Deformation-chart for individual bonds
(wire-thickness versus bonding-time)

mean and **standard-deviation** (σ)
of the bond-finish-time [msec]



Hesse&Kappe Bonder 7100



Wire pulltest

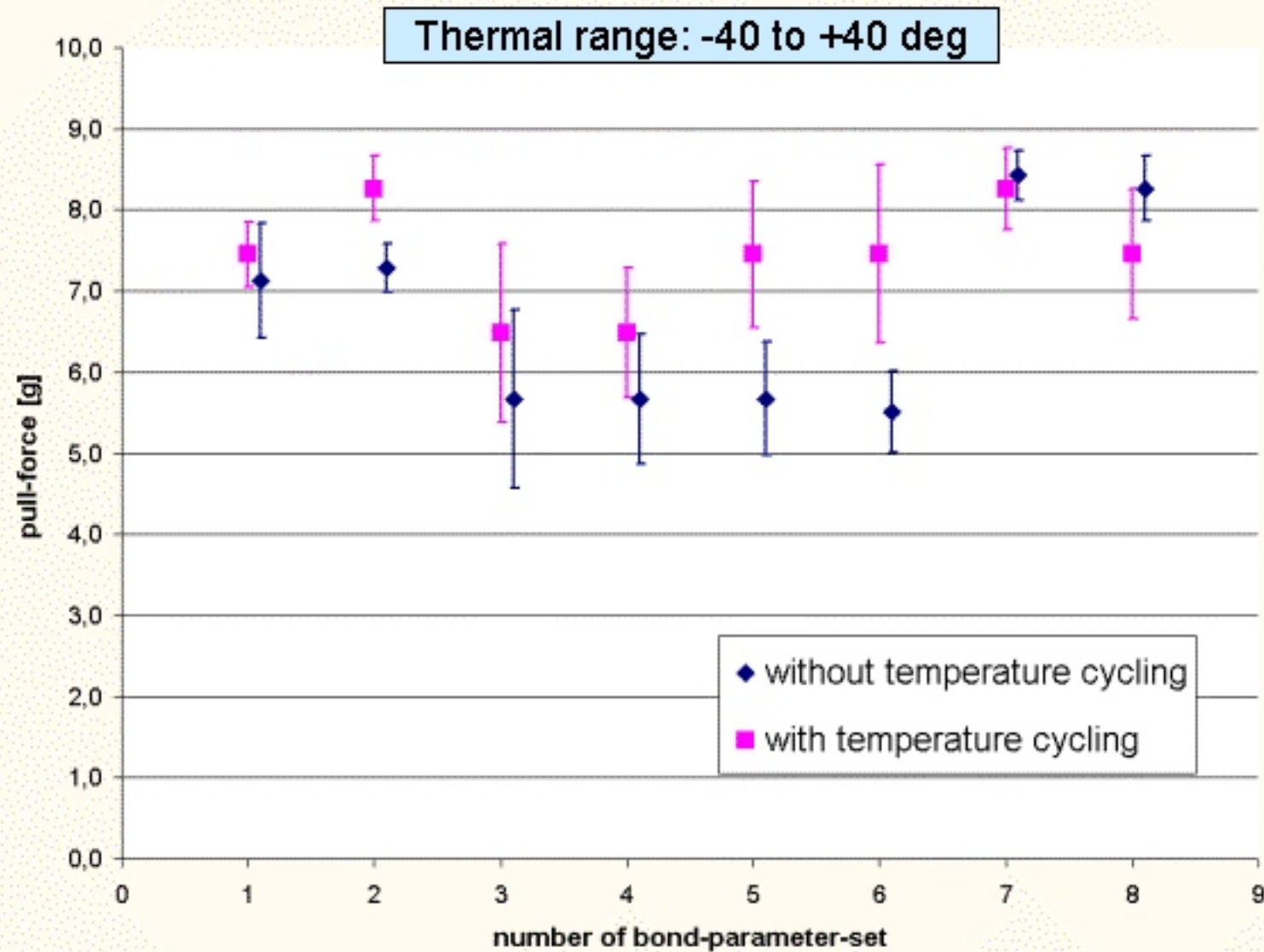
Samples A (temperature-cycled)

wire	AL 25 μm
loopheight	300
loopform	70%
bondingtime	45 ms
number of bonds	30

Statistics:
 not cycled: 205 Bonds 174 heelcrack+31 lift-off
 Temp-cycl: 232 Bonds 217 heelcrack+15 lift-off

test N°	source:			destination:			statistic bondjet:				statistic pulldtest:		
	max.deformation	ultrasonic level	bondingforce	max.deformation	ultrasonic level	bondingforce	t_M	σ	V_M	σ	F_M	σ	F
1	40%	13%	24 cN	40%	13%	24 cN	31,1 ms	6,3	9,9 μm	0,6	4,6	0,7	7,5
2	35%	13%	24 cN	35%	13%	24 cN	26,7 ms	4	8,8 μm	0,1	5,1	0,3	8,3
3	35%	14%	25 cN	35%	14%	25 cN	17,6 ms	4,3	8,9 μm	0,4	4,0	1,1	6,5
4	35%	15%	26 cN	35%	15%	26 cN	14,7 ms	4	8,8 μm	0,1	4,0	0,8	6,5
5	35%	12%	23 cN	35%	12%	23 cN	23,5 ms	6,1	8,9 μm	0,4	4,6	0,7	7,5
6	35%	15%	23 cN	35%	15%	23 cN	16,2 ms	5,4	9,1 μm	0,7	4,6	0,5	7,5
7	35%	12%	26 cN	35%	12%	26 cN	21,0 ms	2,4	8,8 μm	0,1	5,1	0,3	8,3
8	38%	12%	26 cN	38%	12%	26 cN	36,2 ms	9,4	8,9 μm	1,3	4,6	0,4	7,5

Bondstrength with and without thermal cycling





Conclusions:



Not only the **absolute value** of the pull-force indicates a good set of bonding – Parameters:
a **small standard-deviation** is even more important.

Once a bond is tight, it remains
unaffected from thermal cycling

If the standard-deviation is small for the deformation-parameters from the bonder, then it is also small for the pull-tests