



2023 IEEE International Conference on Information Technologies – InfoTech 2023 September 20-21, 2023



E06. Sustainable low-temperature stress soldering of specialized electronic components and process optimization through statistical analysis and machine learning



Associate Professor at the Technical University of Sofia, scientific and applied interests in management of technologies for assembly, quality, automation, production and documentation.

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GOAL :

Ensuring an optimal soldering process regarding low void content in solder joints for specialized complex electronic components.



TASKS :

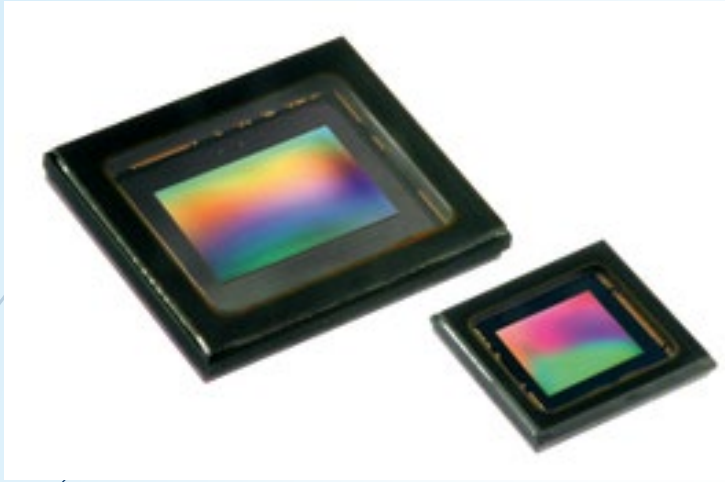


1. *Measurement of the content of voids after soldering with standard reflow modes on a small optical sensor (standard solder paste and BGA housing) and on a large optical sensor (low temperature solder paste and LGA housing);*
2. *Optimizing the reflow mode for soldering using machine learning;*
3. *Measurement of the content of voids after soldering with the optimized reflow mode;*
4. *Statistical comparison of the results when using the two soldering modes;*
5. *Conclusions about creating optimal modes for soldering complex and expensive elements.*

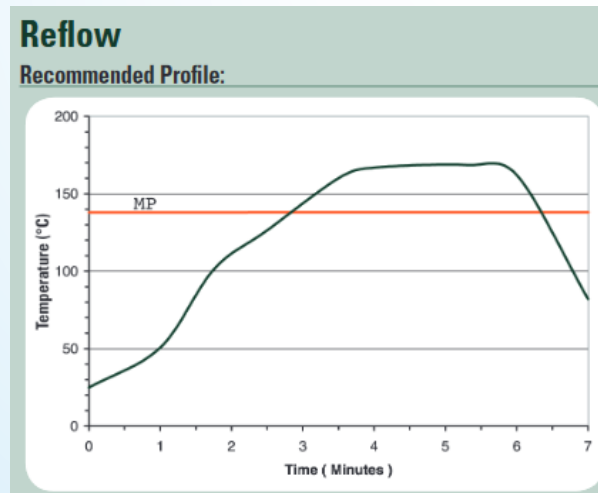
Experiment - Reflow process (vapor phase oven)

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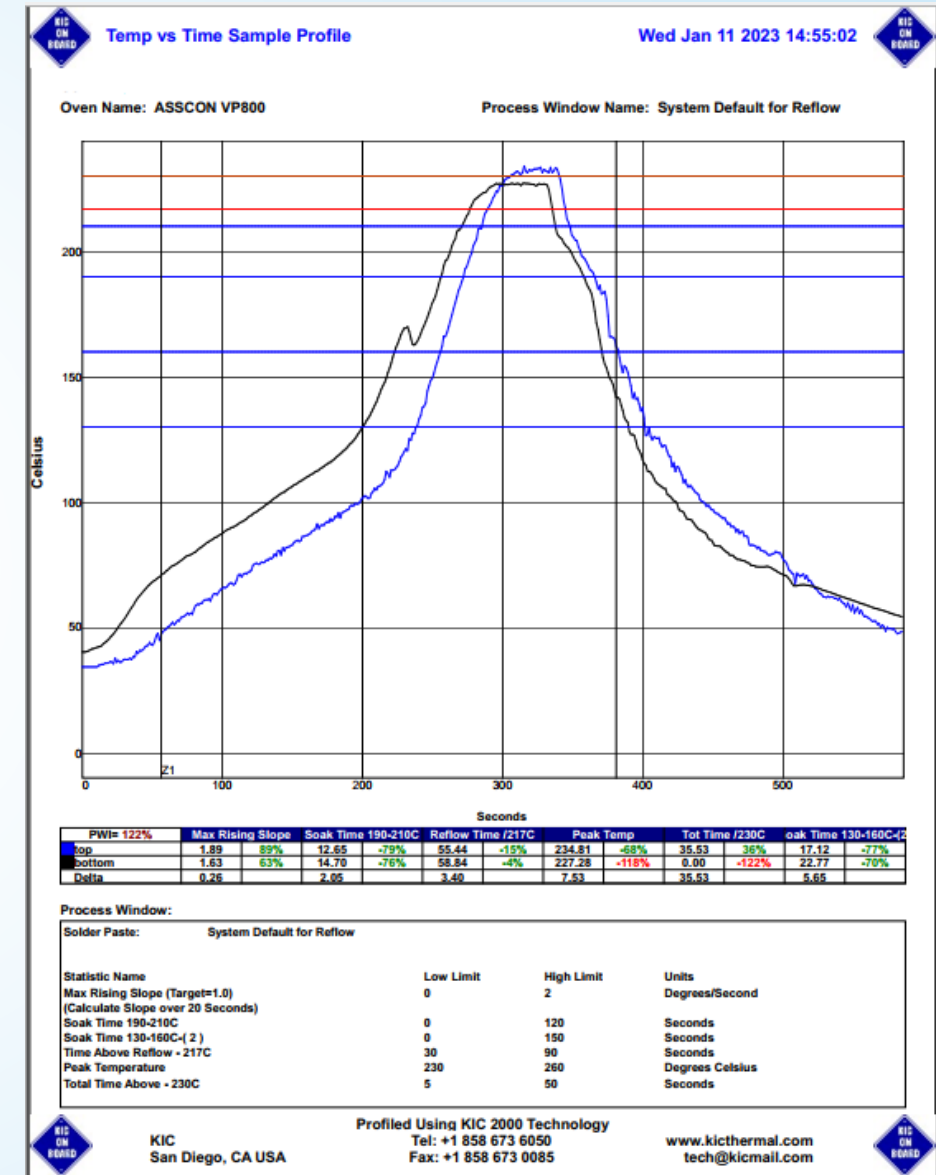
4



SONY CCD sensors



Indium 5.7LT reflow profile for big sensor

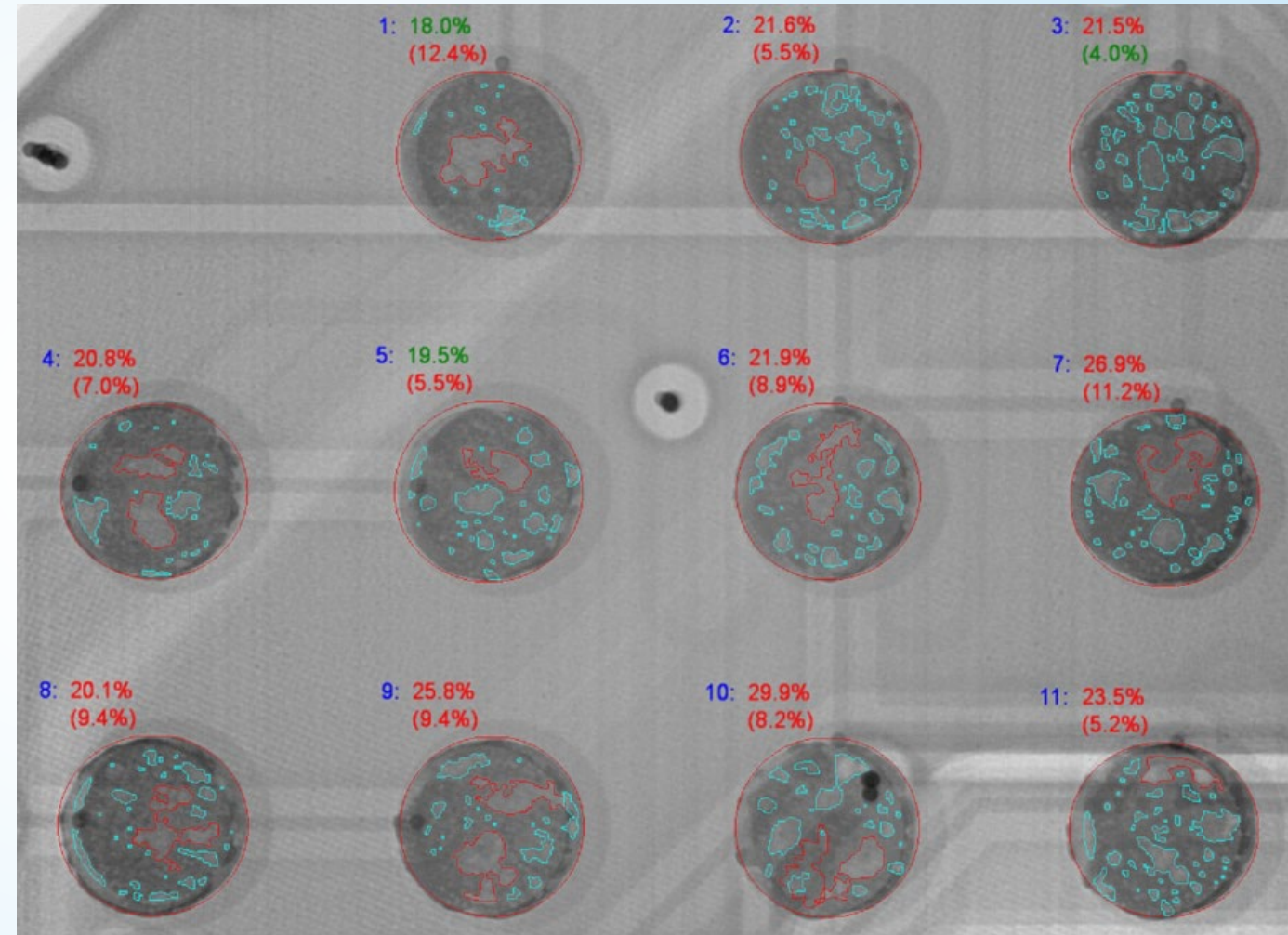


Reflow profile for small sensor

Results after standard soldering

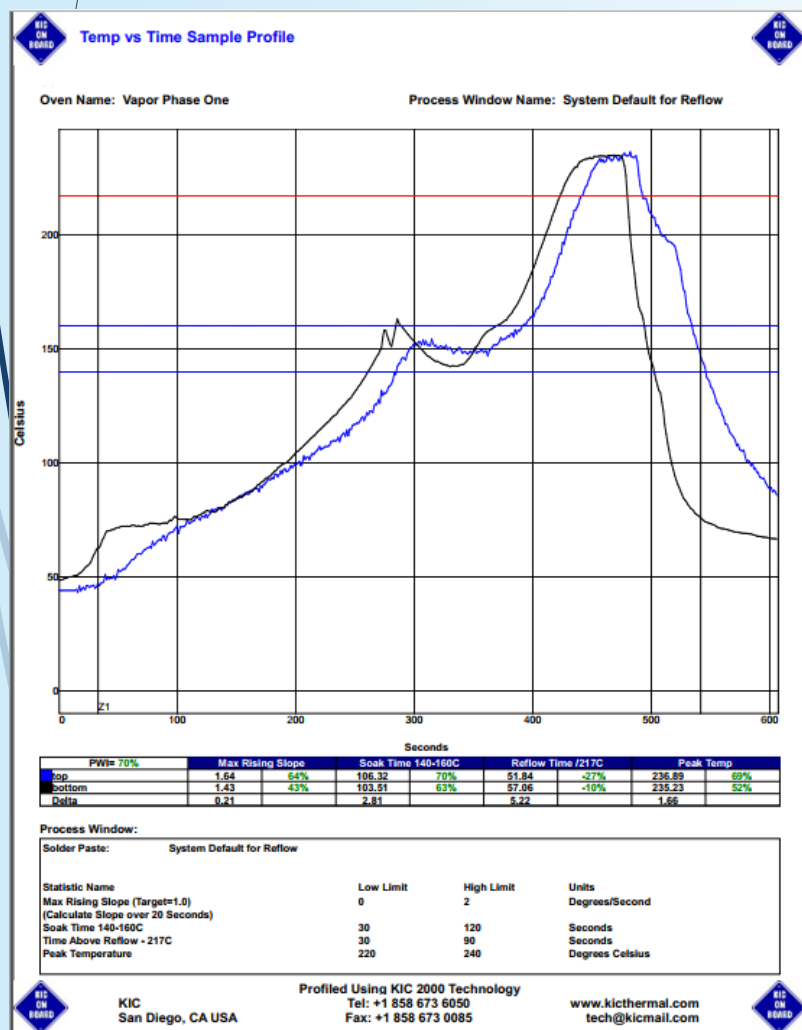
Pad Number	Void Ratio	Void Count	Grade
1	11.9%	1	Fail
2	7.1%	4	Pass
3	14.5%	3	Fail
4	0.6%	1	Pass
5	5.0%	1	Fail
6	11.7%	1	Fail
7	0.0%	0	Pass
8	0.3%	1	Pass
9	0.4%	2	Pass
10	0.4%	1	Pass
11	0.0%	0	Pass
12	22.0%	1	Fail
13	0.0%	0	Pass
14	1.7%	1	Pass
15	53.3%	1	Fail
16	0.2%	1	Pass
17	0.0%	0	Pass
18	0.0%	0	Pass
19	10.7%	1	Fail
20	33.6%	1	Fail
21	17.1%	2	Fail
22	21.6%	1	Fail
23	15.3%	2	Fail
24	9.4%	1	Fail

Small sensor



Big sensor

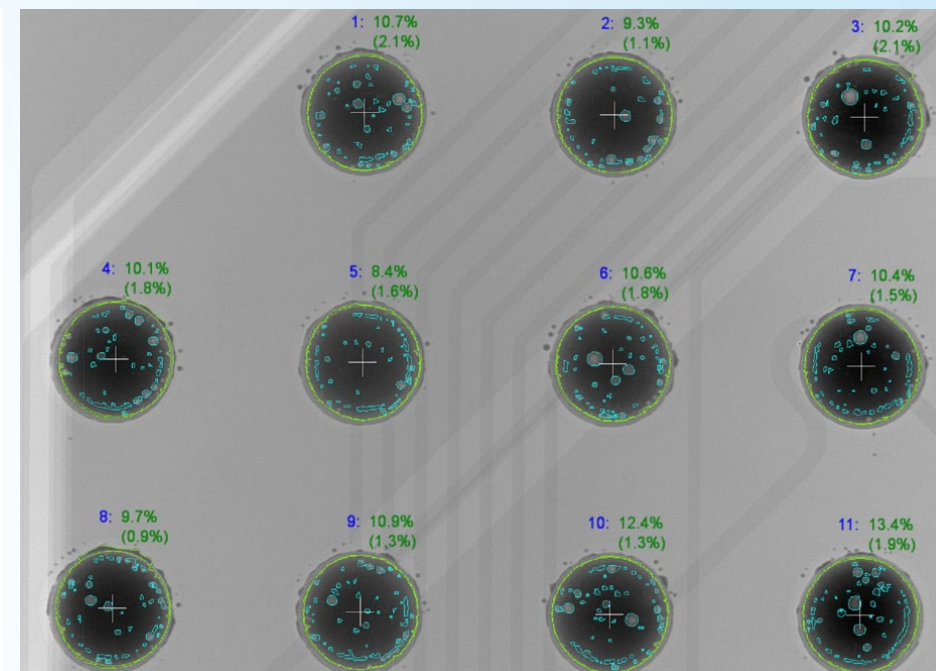
Results after optimization of soldering



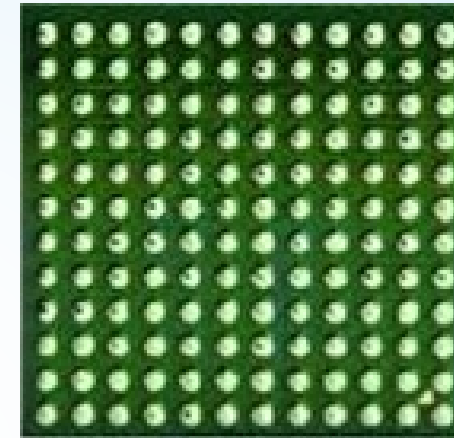
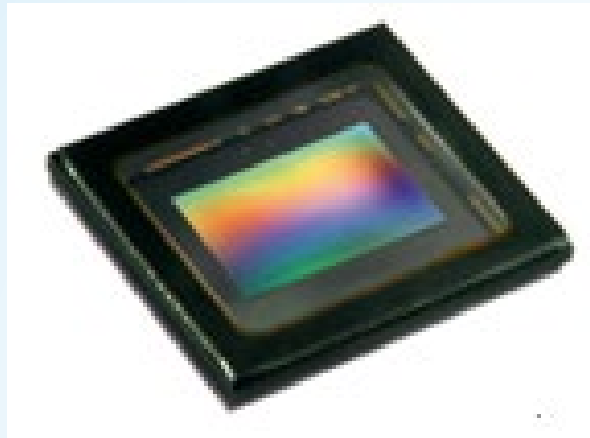
New reflow profile

Pad Number	Void Ratio	Void Count	Grade
1	4.6%	1	Pass
2	9.2%	2	Fail
3	5.5%	2	Pass
4	12.0%	3	Fail
5	0.0%	0	Pass
6	19.1%	1	Fail
7	7.6%	1	Fail
8	0.0%	0	Pass
9	9.4%	3	Fail
10	12.1%	3	Fail
11	13.7%	2	Fail
12	35.2%	3	Fail
13	0.0%	0	Pass
14	3.5%	2	Pass
15	0.0%	0	Pass
16	5.1%	1	Fail
17	5.4%	2	Pass

Small sensor



Big sensor



Total Area	35759430
Pad Count	24
Total Pad Area	5841722
Total Pad Area Ratio	16.3%
Total Void Area	617455
Total Void Area Ratio	10.6%

Total Area	35759437
Pad Count	17
Total Pad Area	3985422
Total Pad Area Ratio	11.1%
Total Void Area	338408
Total Void Area Ratio	8.5%

Conclusions

FROM THE ANALYSIS OF THE RESULTS OBTAINED WHEN SOLDERING THE TWO SENSORS WITH A LOW TEMPERATURE LOAD, WE CAN CONCLUDE THAT THE IMPROVEMENT OF THE PROCESS PARAMETERS USING MACHINE LEARNING ALLOWS TO QUICKLY FIND OPTIMAL PROCESS PARAMETERS.

Thank you for your attention!

An African proverb: *"He who looks well will finally see."*

This research is supported by Bulgarian National Science Fund in the scope of the project "Exploration the application of statistics and machine learning in electronics" under contract number KII-06-H42/1.