
Incode

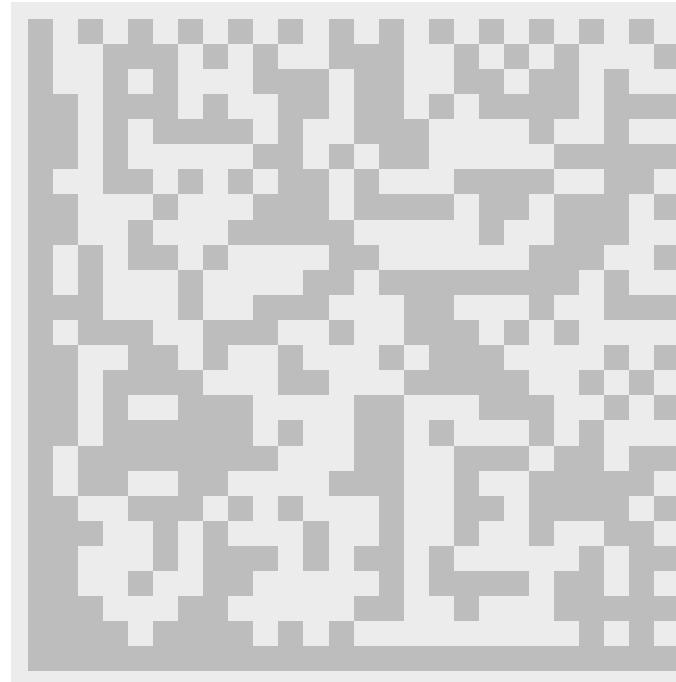
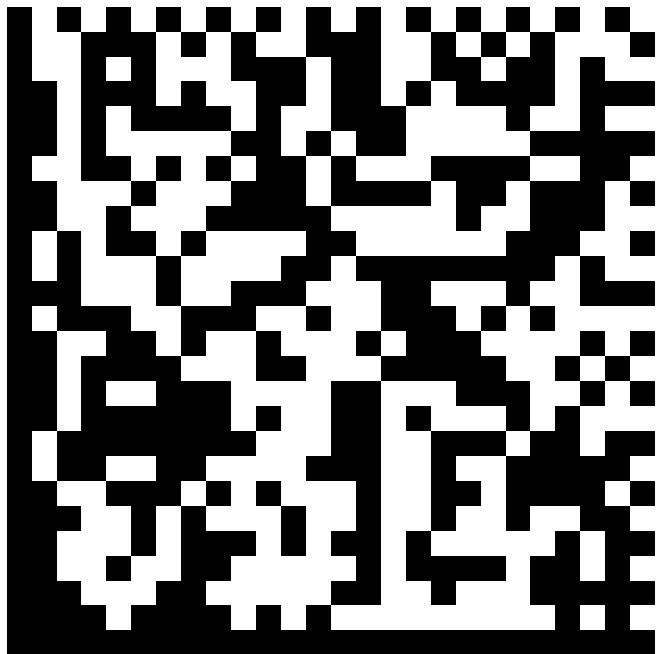
Fraunhofer Institute for Manufacturing Engineering and Automation, Germany

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Application of the tracing inks and detection of the images

- Within this project, more than 25 tracing inks, consisting of different binders and 28 IR additives, were evaluated for their IR-marking properties.
- The screening testing of the marking inks was performed for doctor blade applications on paper. The determination of the contrast values was performed using a FIR camera.
- For a selection of marking inks, the matrix codes were printed on paper and different textiles and decoding experiments were performed.

Contrast of the applied codes

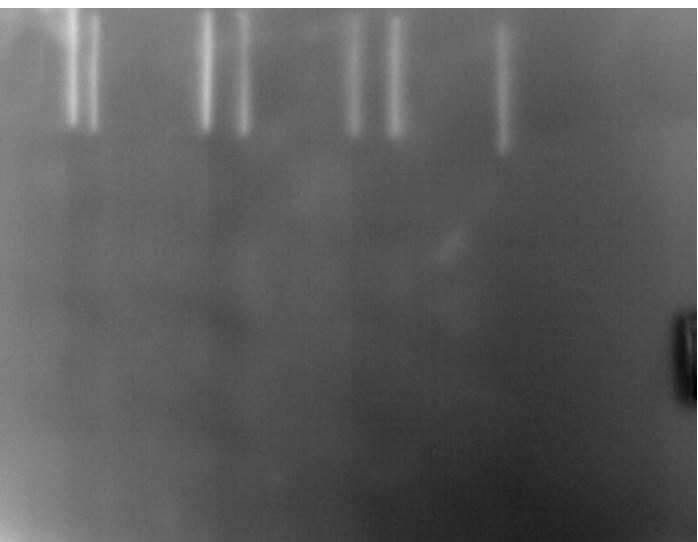
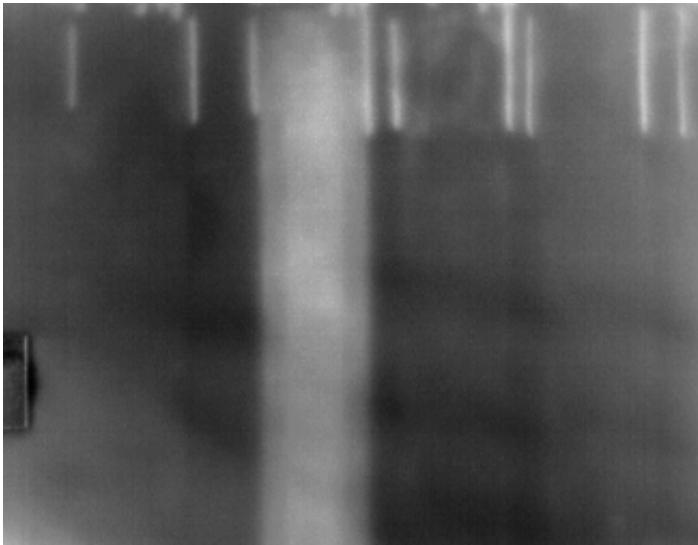


maximum contrast

contrast value: 4,0

$$\text{contrast value} = \frac{I(\text{light section}) - I(\text{dark section})}{I(\text{light section}) + I(\text{dark section})}$$

Screening of tracing inks with new IR additives for doctor blade applications on paper



Tracing ink No.	IR contrast
8	0,04
9	0,54
10	0,09
14	0,15
15	0,07
16	0,01

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Screening of tracing inks with new IR additives for doctor blade applications on paper



Tracing ink No. IR contrast

11 **0,22**

12 **0,79**

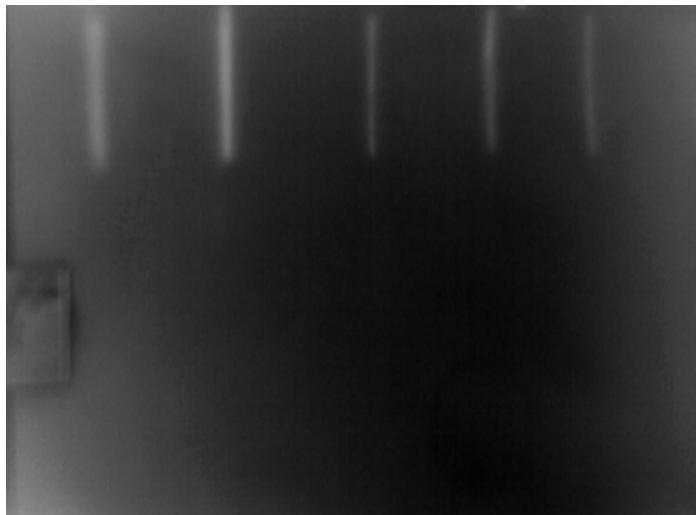
13 **0,06**

17 **0,11**

18 **0,19**

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Screening of tracing inks with new IR additives for doctor blade applications on paper



Tracing ink No.	IR contrast
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19	0,02
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20	0,04
----	-------------

21	0,22
----	-------------

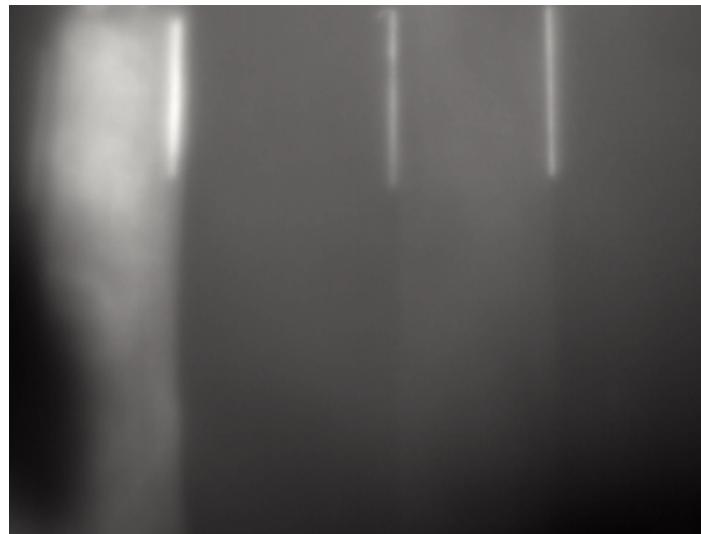
22	1,13
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23	1,37
----	-------------



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Screening of tracing inks with new IR additives for doctor blade applications on paper



Tracing ink No.	IR contrast
24	1,37
25	0,22

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Properties of the printed matrix codes

Color difference (DE*) of printed matrix codes on paper

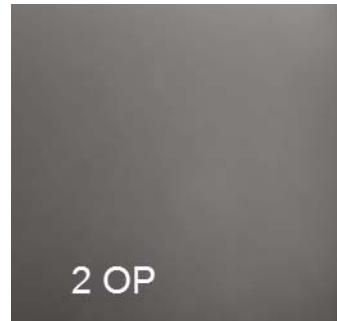
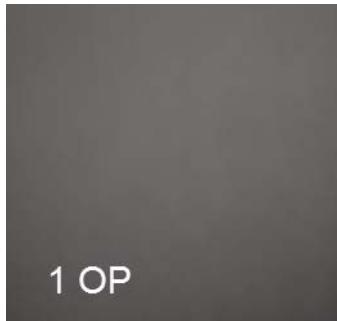
Tracing ink No.	DE* / D65
8	1,327
9	1,102
10	2,518
11	4,323
12	3,558
13	8,029
14	1,020
15	2,961
16	0,921
17	1,306
18	1,241
19	1,094
20	1,206
21	2,554
22	2,198
23	3,554
24	3,556
25	3,618

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Printing of matrix codes on paper

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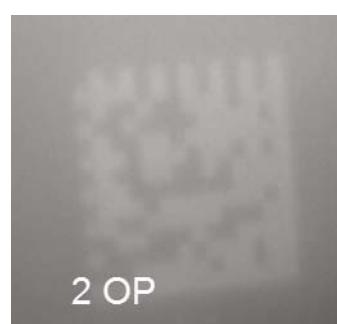
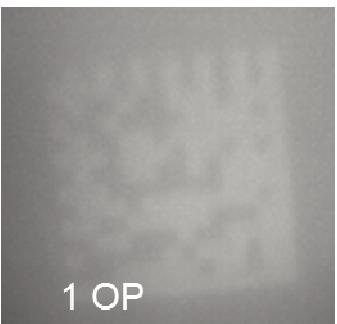
IR contrast of matrix codes on paper



Tracing ink No.8; overprints / OP

IR contrast

1 OP	0,00
2 OP	0,00
3 OP	0,04

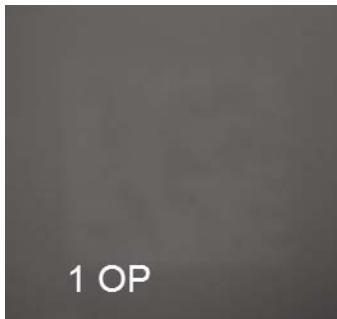


Tracing ink No.9; overprints / OP

IR contrast

1 OP	0,18
2 OP	0,22
3 OP	0,19

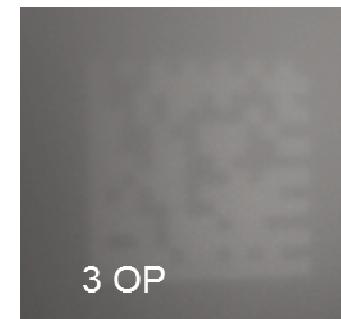
IR contrast of printed matrix codes on paper



1 OP



2 OP



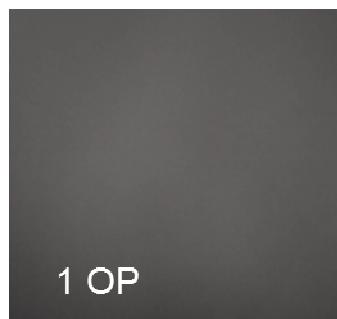
3 OP

Tracing ink No.10; overprints / OP

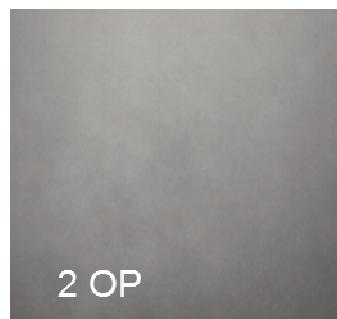
IR contrast

1 OP
2 OP
3 OP

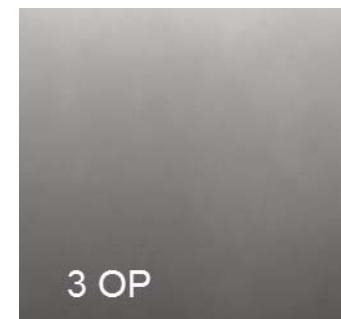
0,00
0,09
0,10



1 OP



2 OP



3 OP

Tracing ink No.15; overprints / OP

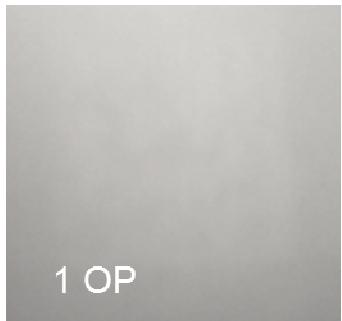
IR contrast

1 OP
2 OP
3 OP

0,00
0,00
0,00

12

IR contrast of printed matrix codes on paper



1 OP



2 OP



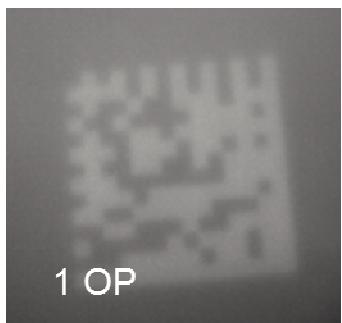
3 OP

Tracing ink No.11; overprints / OP

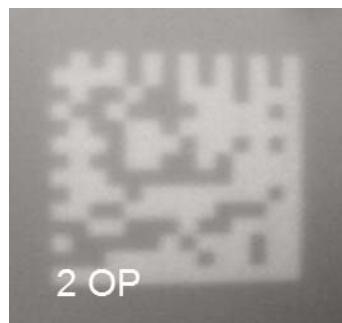
IR contrast

1 OP
2 OP
3 OP

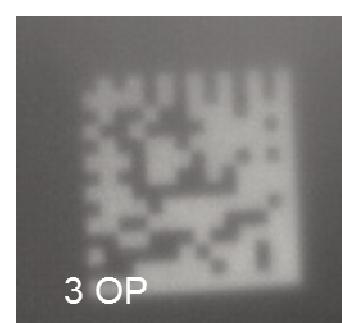
0,05
0,16
0,15



1 OP



2 OP



3 OP

Tracing ink No.12; overprints / OP

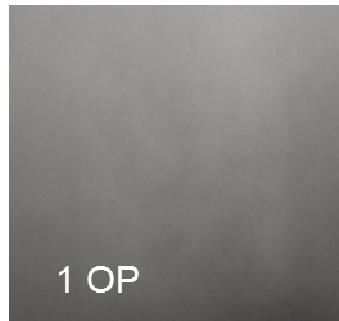
IR contrast

1 OP
2 OP
3 OP

0,22
0,34
0,58

13

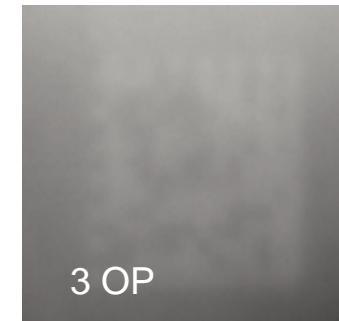
IR contrast of printed matrix codes on paper



1 OP



2 OP



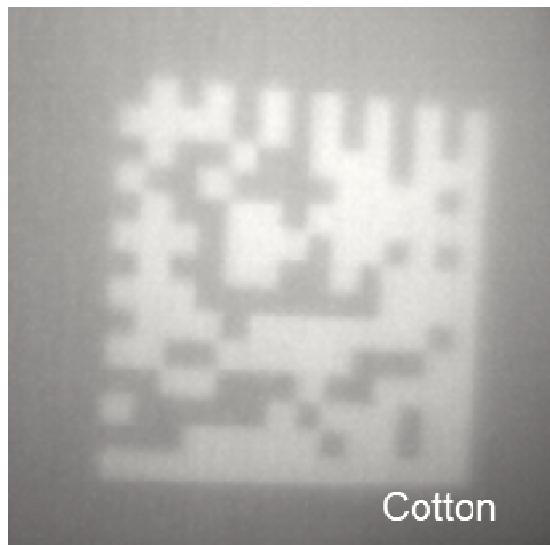
3 OP

Tracing ink No.13; overprints / OP

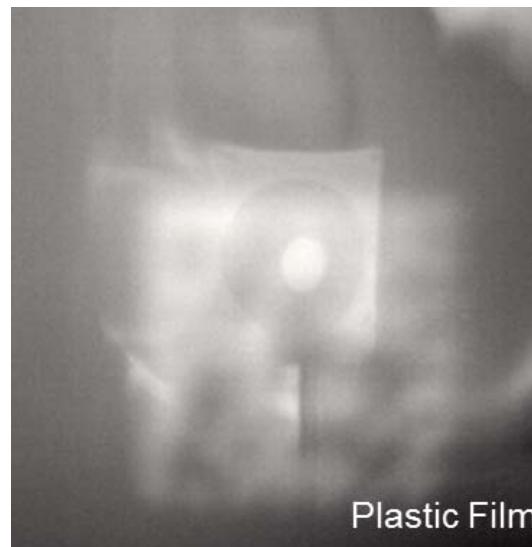
IR contrast

1 OP	0,00
2 OP	0,04
3 OP	0,15

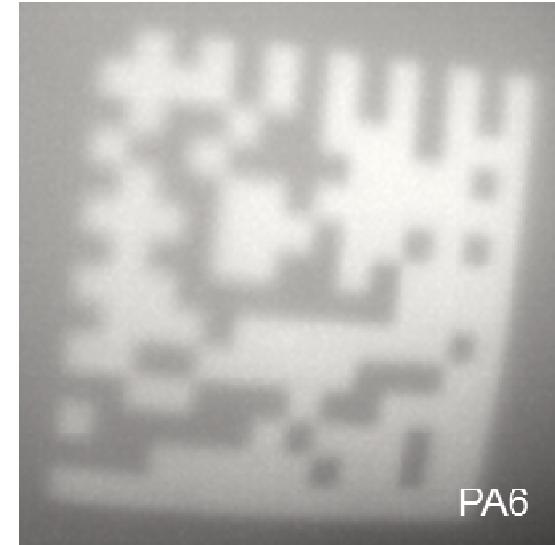
Tracing ink 12 printed with three overprints on different substrates



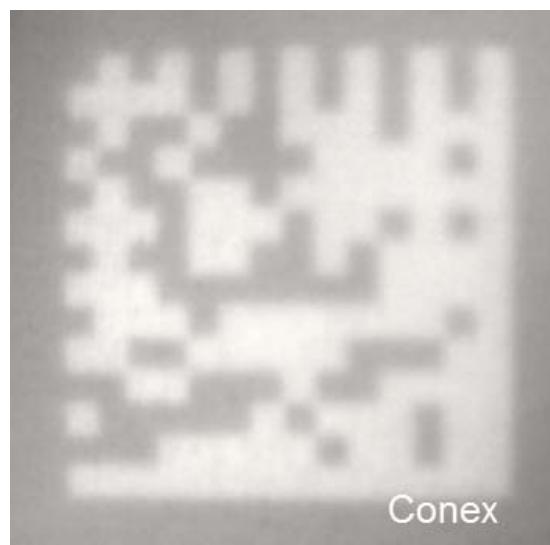
Cotton



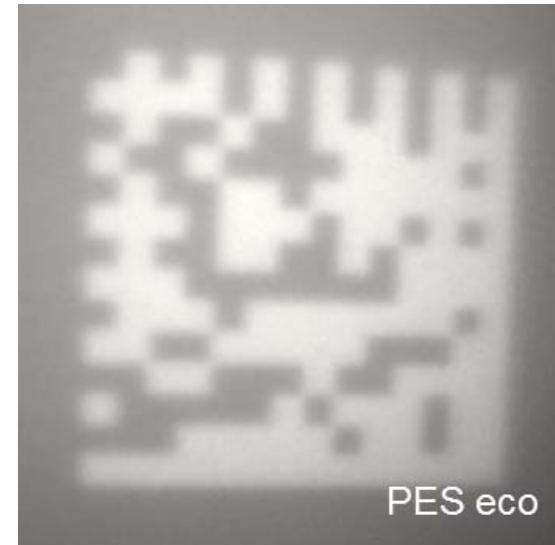
Plastic Film



PA6



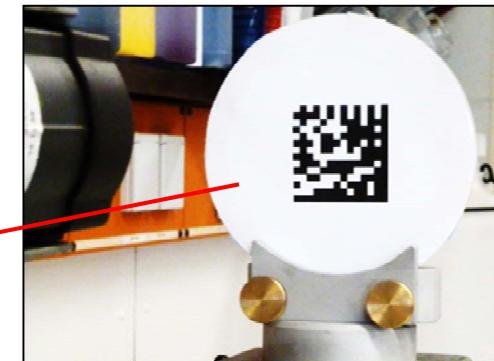
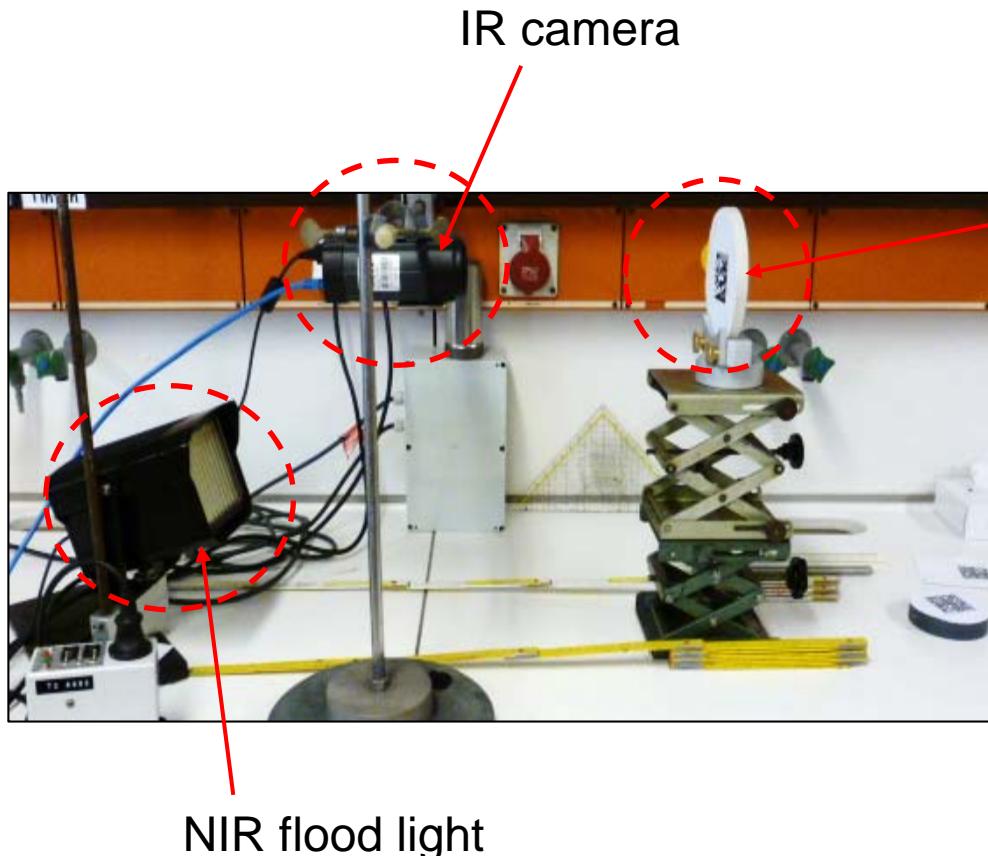
Conex



PES eco

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Measurement setup for the detection of 2D matrix codes



Textile sample with
inkjet printed 2D code



IR video

Selection of printed matrix codes with different IR contrasts on paper

Tracing ink / OP	Contrast	decodable with software from		
		AT	Steribar	mobile phone 2D scanner
 Probe 2.0 - 1 OP	Ink 9 / 1 OP	0,18		
	Ink 9 / 2 OP	0,22		
	Ink 9 / 3 OP	0,19		
 Probe 6.2 - 1 OP	Ink 12 / 1 OP	0,22		
	Ink 12 / 2 OP	0,34		
	Ink 12 / 3 OP	0,58		

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Our aim are code detections like these...



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Summary

- The tracing ink formulation, which is optimized on the decoding properties, was given to the partner institutes for application and testing on different substrates.
- Tracing ink formulations containing new IR additives were developed.
- Tracing ink 12 gives a good IR contrast, which can be decoded, if the appropriate software is used.

Follow-up

- Optimization of marking inks referring to IR contrast and fastness properties.
- Improvement of decoding process.