

A study on detection of distribution facilities deterioration with active thermography method

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Introduction

Background

Porcelain insulators and organic insulators are used in large quantities for distribution facilities.

○ Deterioration

Porcelain insulator : Cracks

Organic insulator : Trackings

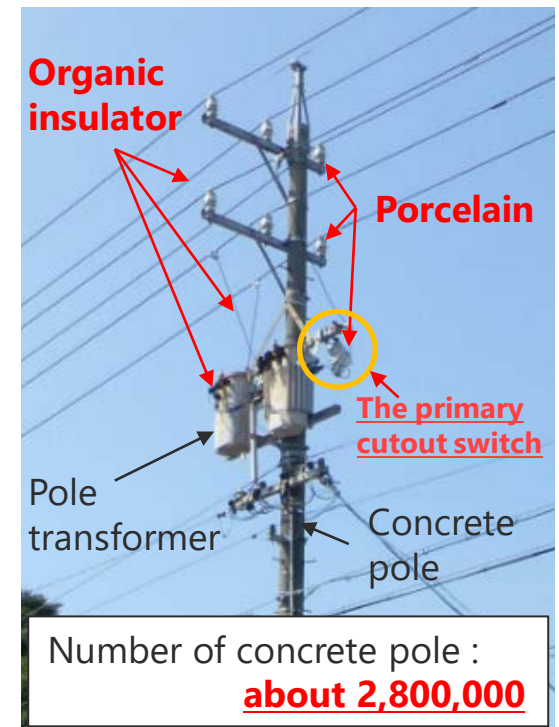
○ It was difficult to visualize deterioration

○ Influence

Decrease of insulating performance,

Fall of facilities

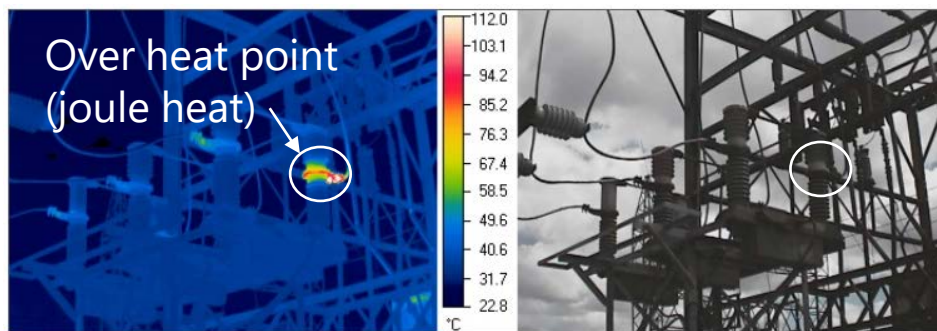
Supply troubles may occur more.



Issues of thermography method for distribution facilities

The thermography method is classified roughly into...

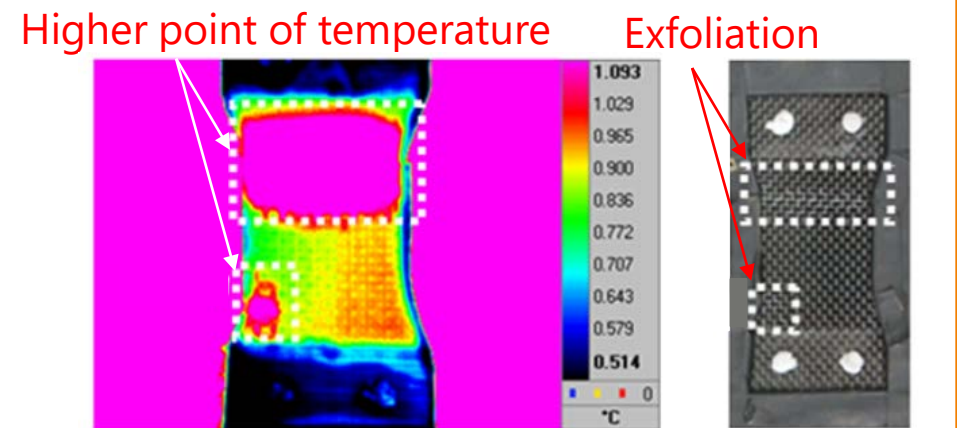
① The passive method



Thermography image Substation connectors

The source : Nippon Avionics Co.,Ltd. "Thermal Image : Substation Connector"

② The active method

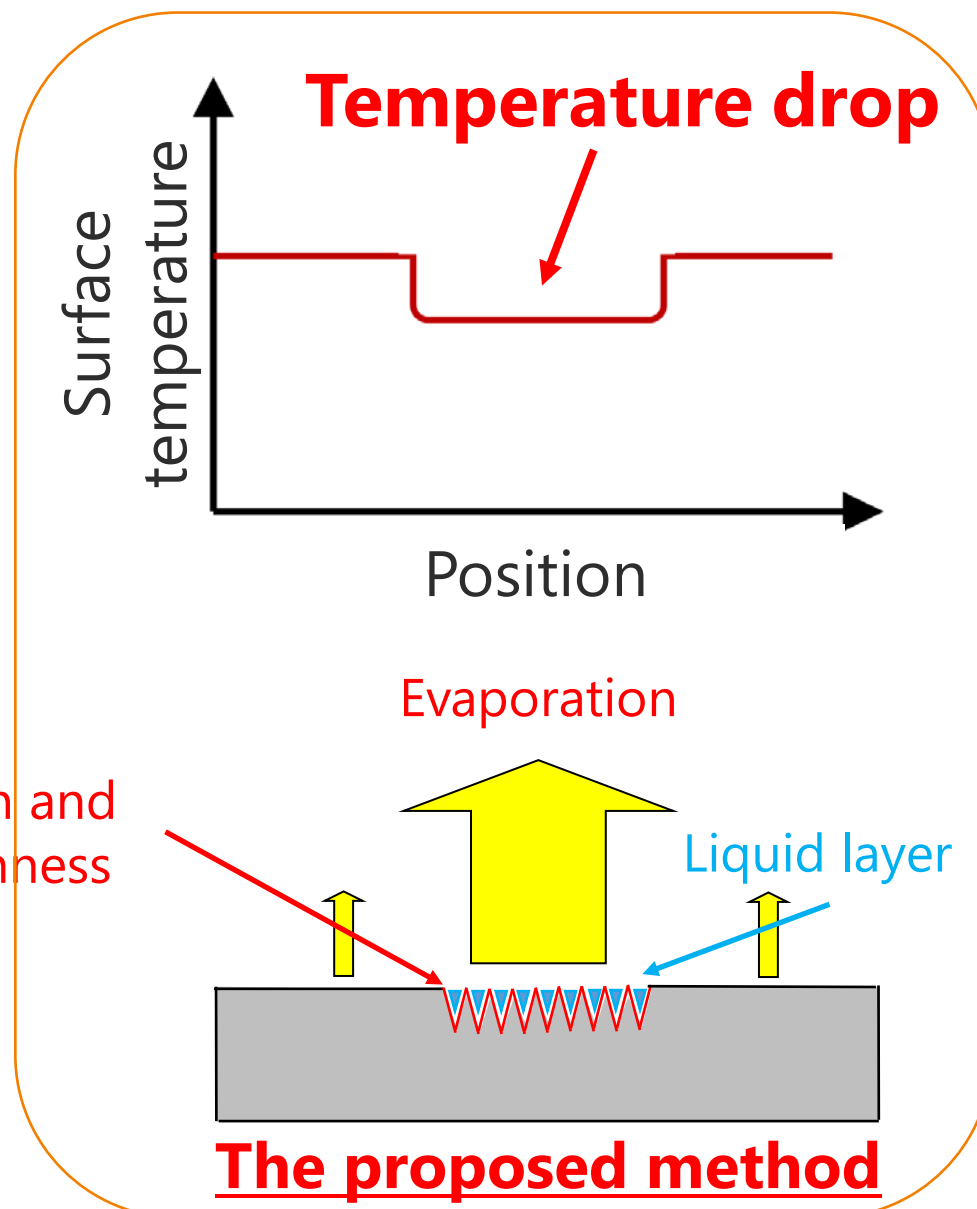
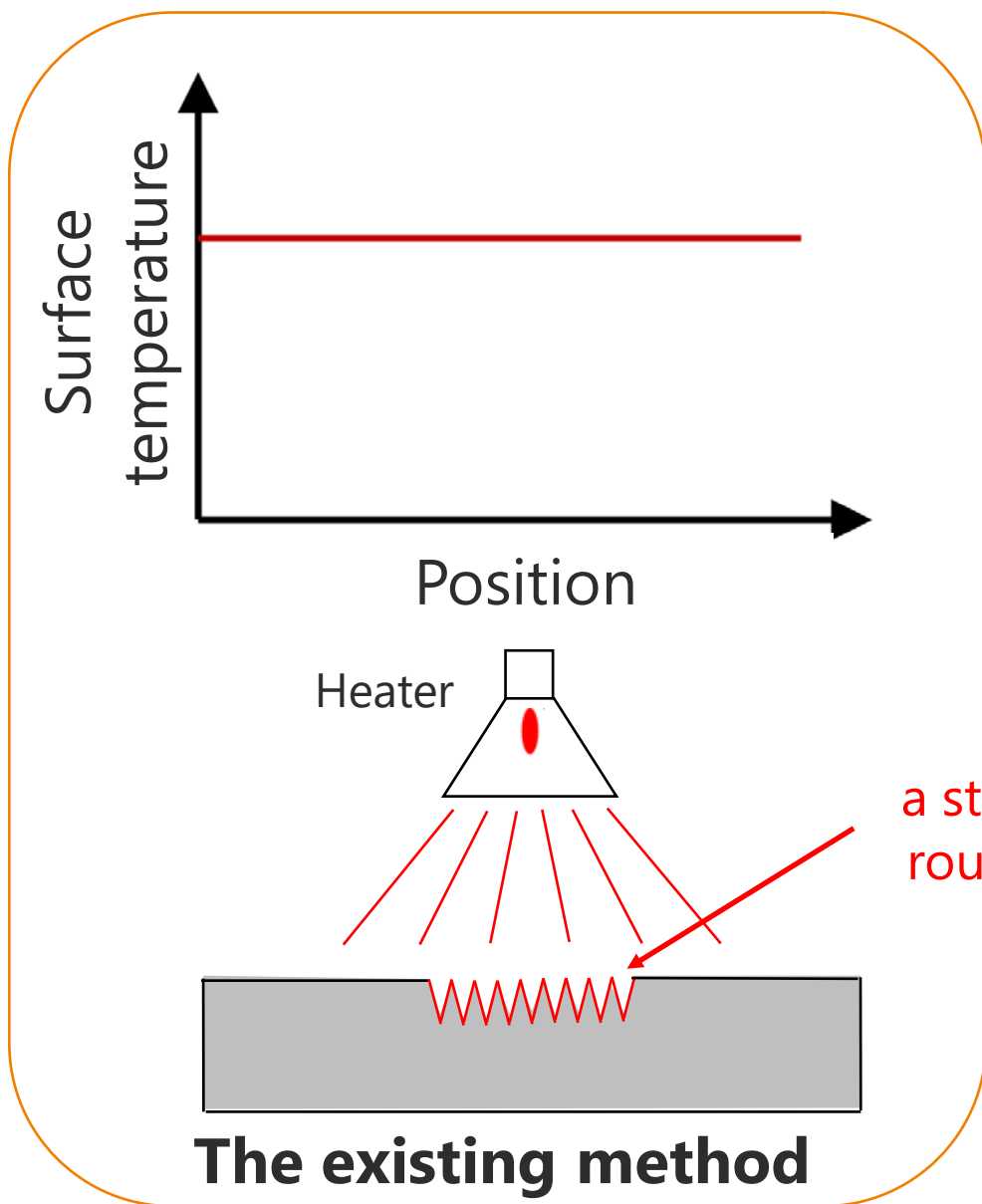


Thermography image CFRP sample

The source : JFE Techno-Research :
"Inspection/Measurement: Defect Detection Technology"

02

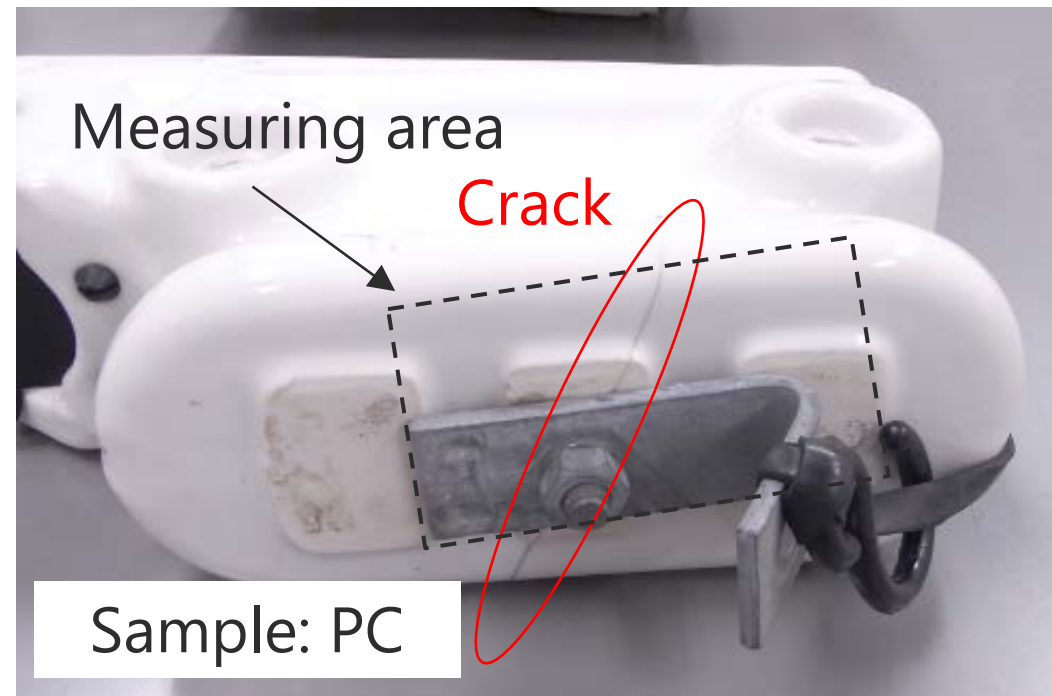
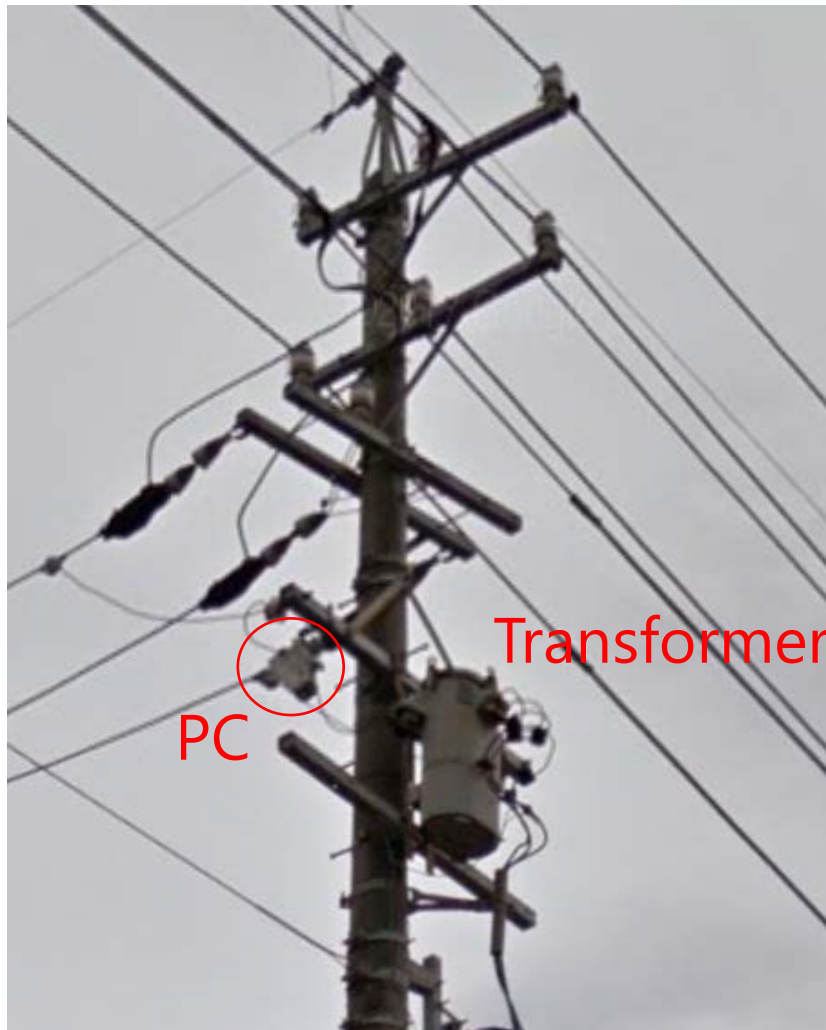
Details of proposed method



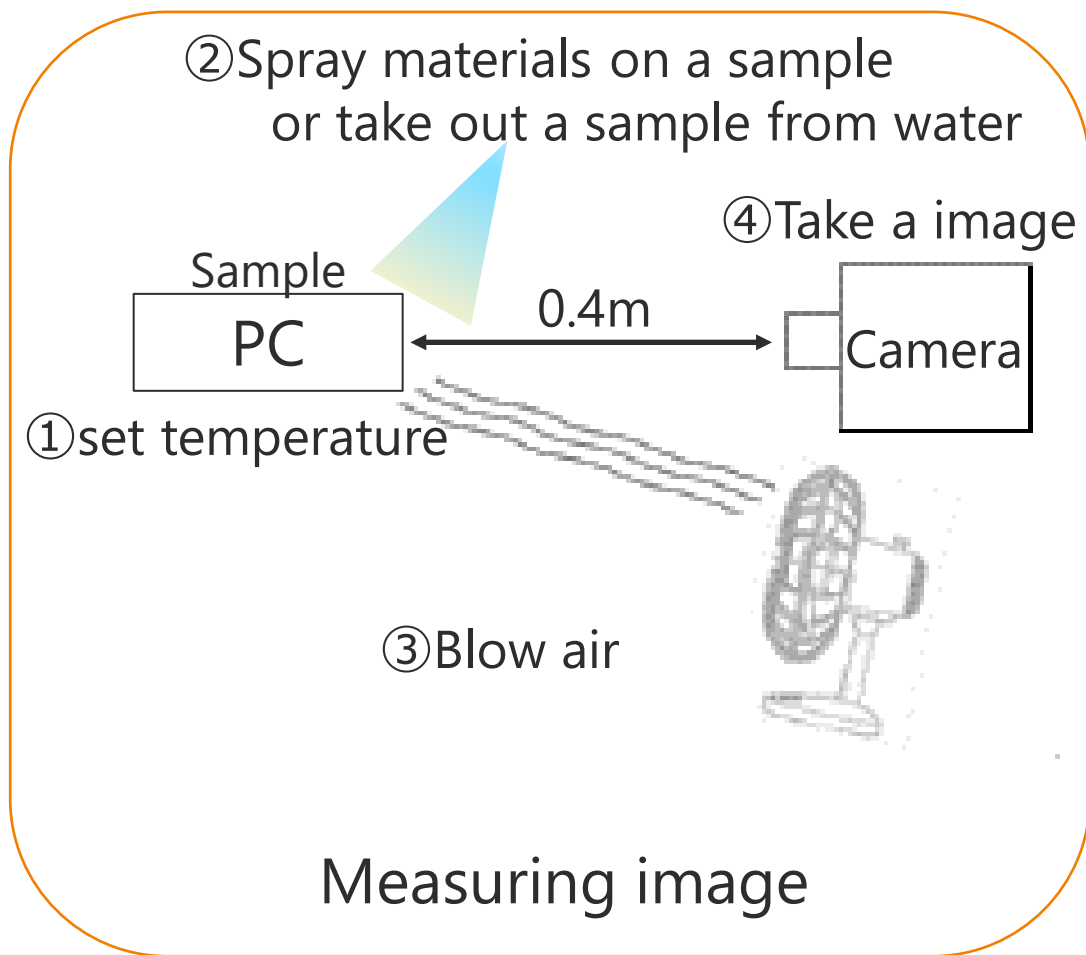
03

Results of a detection of facilities deterioration

Sample : Primary cutout switch (PC)



Measuring condition



Spraying materials

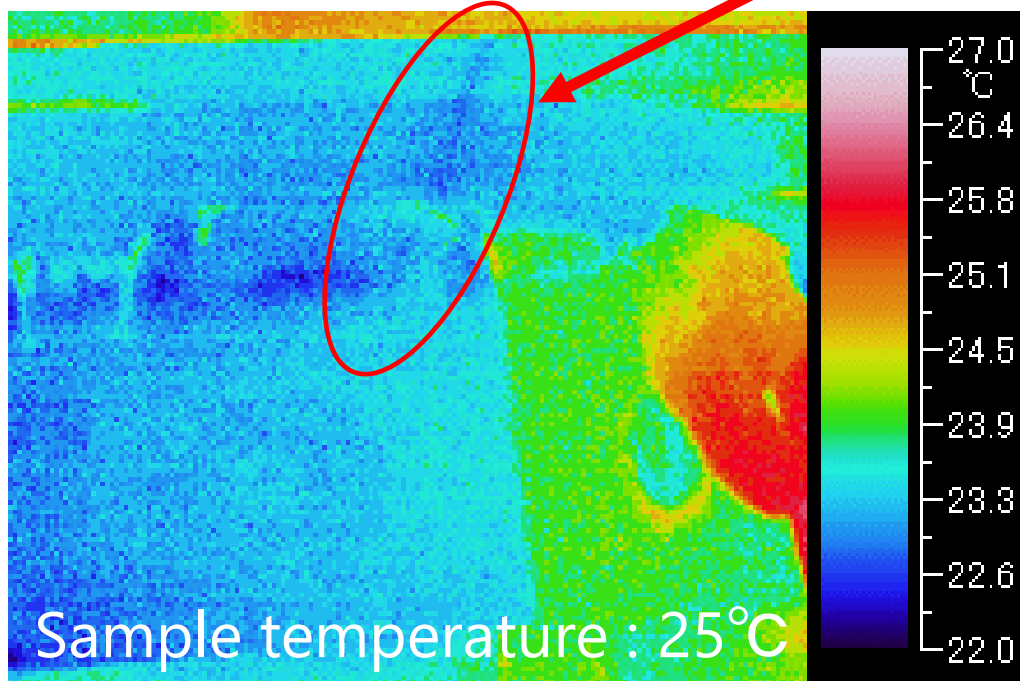
- ① **Water**
- ② **Ethanol**
- ③ **Others**
Cold spray, Steam



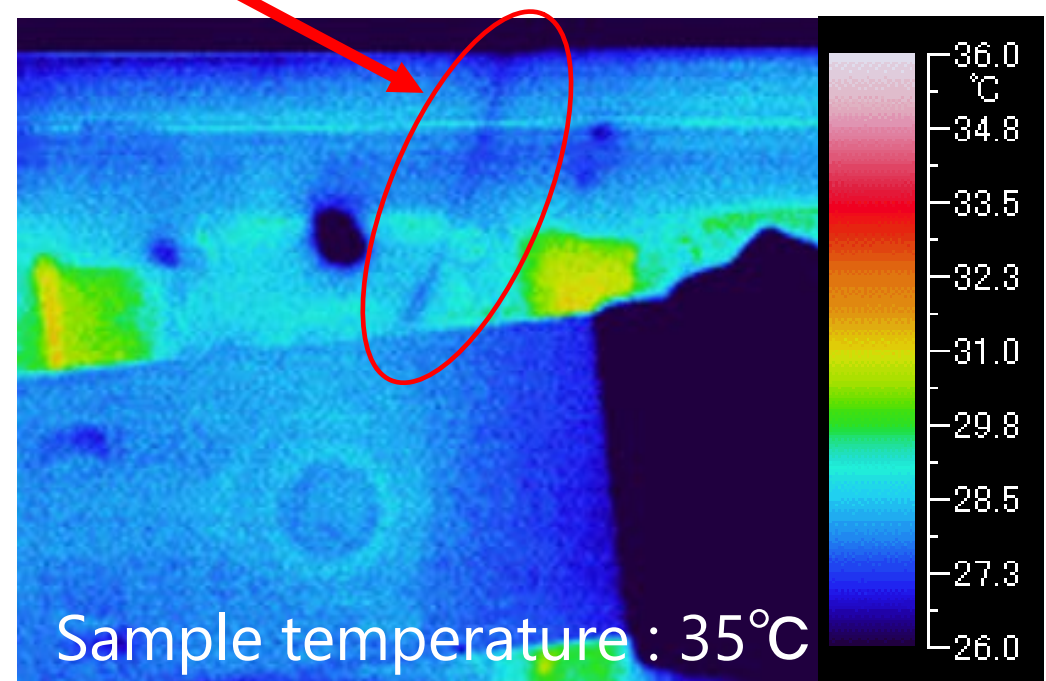
Camera : Pixel number 320(H)×240(V)
Spectral range 8~14μm

A example of thermography (a crack could be detected)

Crack : **Detected**



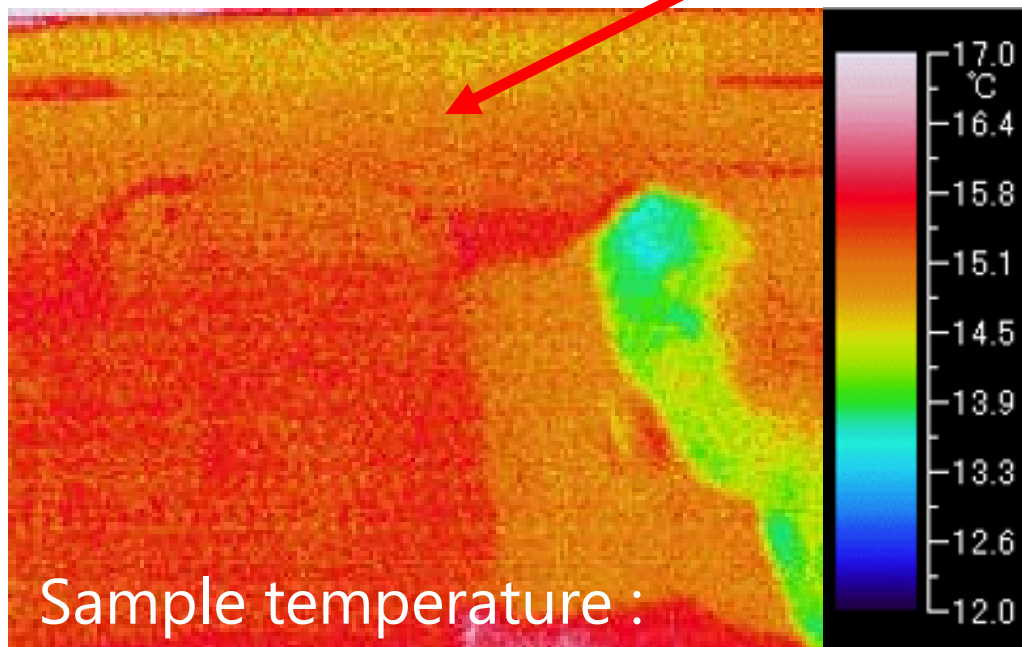
Case 1 (Spraying ethanol)



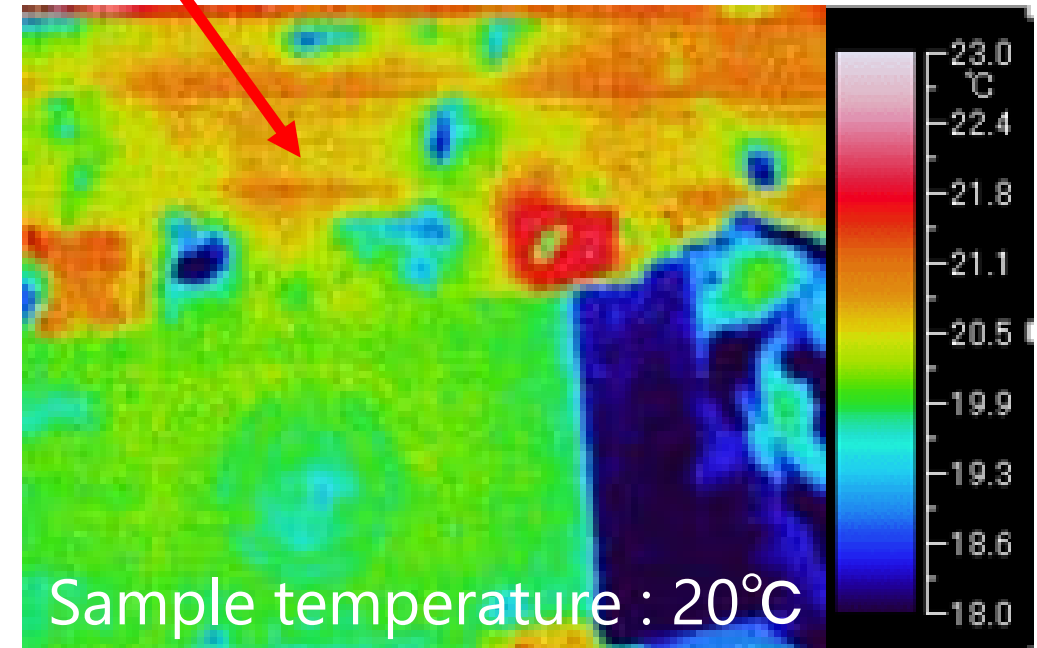
Case 2 (Blowing air to a sample after immersing a sample in water)

A example of thermography (a crack could not be detected)

Crack : Not detected



Case 1 (Spraying ethanol)



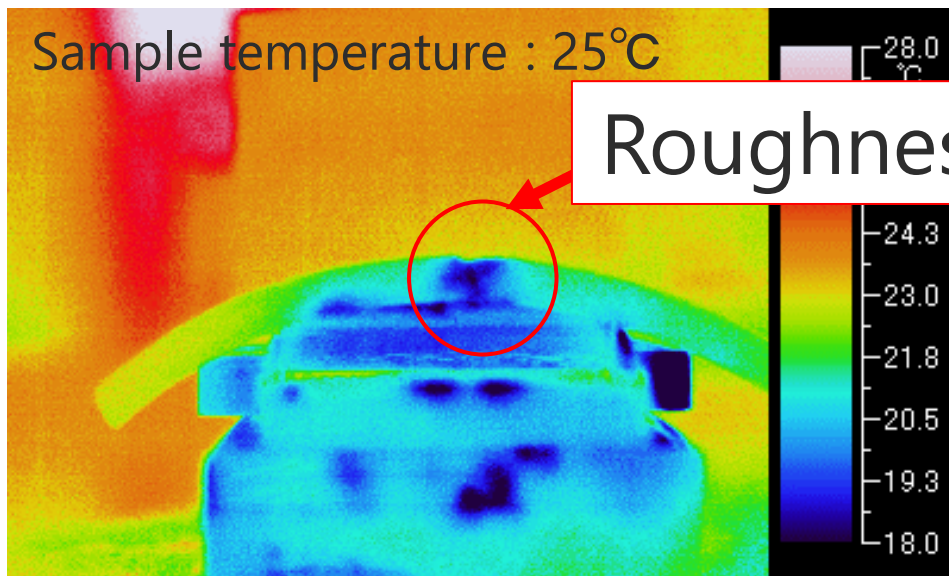
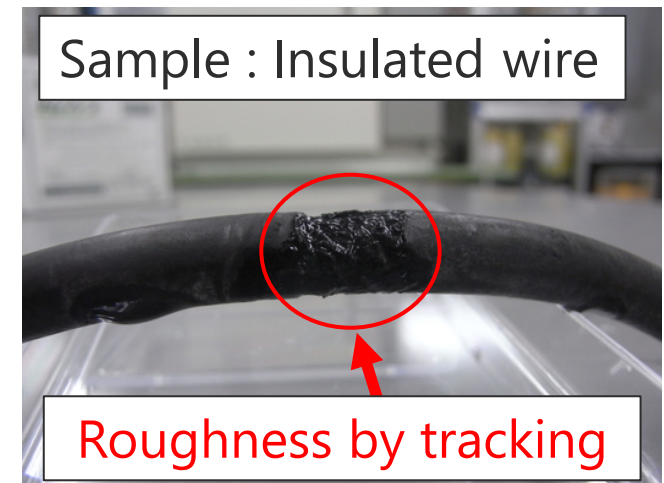
Case 2 (Blowing air to a sample after immersing a sample in water)

Experimental results

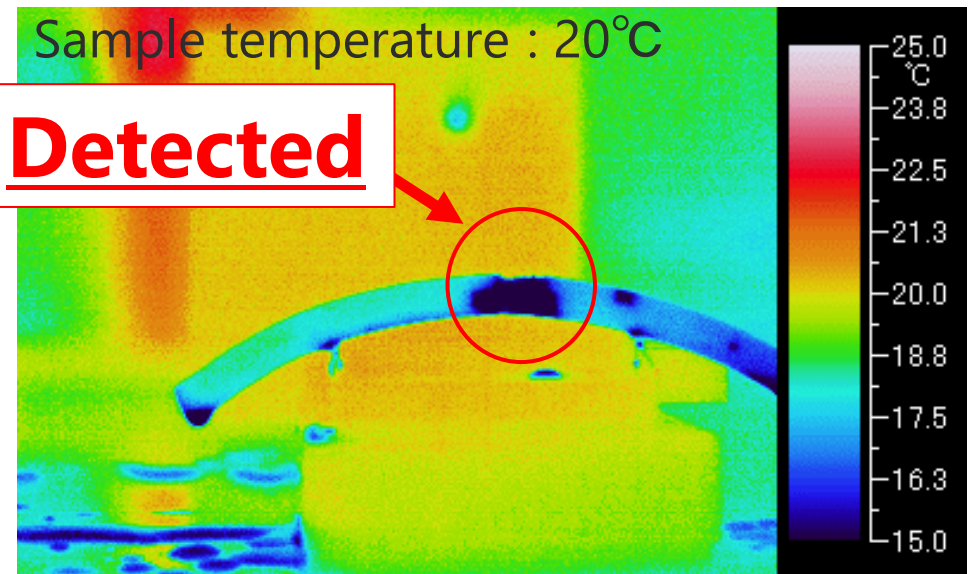
Sample Temp	Dry	Sprayed					Immersing samples in water	
		Water	Ethanol	Cooling spray	Steam	Water Using a blower	Without wind	Using a blower
5°C	×	×	×	△	—	—	×	×
10°C	×	×	×	△		×	×	×
15°C	×	×	×	—	—	—	×	△
20°C	×	×	○	△	×	×	×	△
25°C	×	×	○	—	—	—	×	○
30°C	×	×	○	△	×	×	×	○
35°C	—	—	○	—	—	—	×	○
40°C	×	×	△	△	×	—	×	○
45°C	—	—	—	—	—	—	△	○
50°C	×	×	△	△	×	×	△	○
70°C	—	—	—	—	—	—	—	○

Legends : ○ means that a crack could be detected, △ & × mean that a crack could not be detected

And more...



Case 1 (Spraying ethanol)



Case 2 (Blowing air to a sample after immersing a sample in water)

04

Conclusion

- (1) It is possible for the proposed method using the evaporation of liquid layer **to supply thermal load to facilities in the upper position of the concrete pole easily than the existing method.**
- (2) We confirmed that **the proposed method is effective to detect cracks of PC.**
- (3) We confirmed **that the proposed method can detect facility deterioration in a certain temperature range with the use of different splaying materials.**

Further issues are as follow.

- Evaluation of a working method and its workability
- Influence on diagnostic precision by a noise
(solar radiation, reflection)
- Utilization of other techniques
(drone, AI, image processing), and more.

Thank you for your attention!

