



Research on the measurement of Road Icing Thickness by Infrared laser detection technology

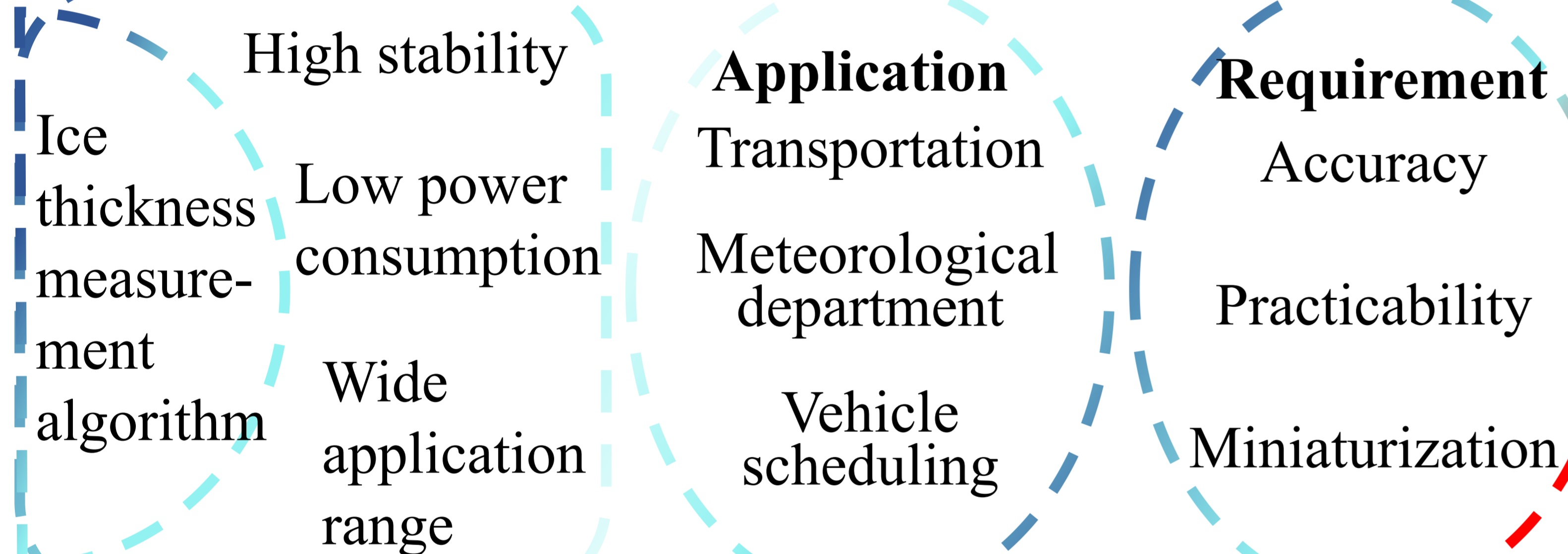
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ABSTRACT

The research of road icing thickness can provide a strong guarantee for vehicle driving safety in ice and snow days. The thicker the ice layer, the lower the wheel friction, the greater the probability of traffic accidents. In this paper, based on the spectral characteristics of ice, an ice thickness measurement algorithm based on differential method is derived. The detection angle is determined by the phase transition process of ice. The laser reflection detection method is used for experimental verification. The experimental results show that the method of dual wavelength cooperative detection of ice thickness can effectively measure the ice thickness, with the characteristics of low cost and low power consumption.

INTRODUCTION



In this paper, we choose the appropriate detection light source, namely 1310nm and 1550nm laser, and use the reflection infrared laser detection principle to measure the ice thickness on the road.

PRINCIPLE AND DEVICE

Ice thickness measurement

- The 1310nm laser is suitable to be used as the main detection light to record the ice thickness information in the freezing climate;
- 1550nm semiconductor laser is selected as auxiliary detection light to reduce the interference caused by ice surface reflection by differential method.

Experimental Device

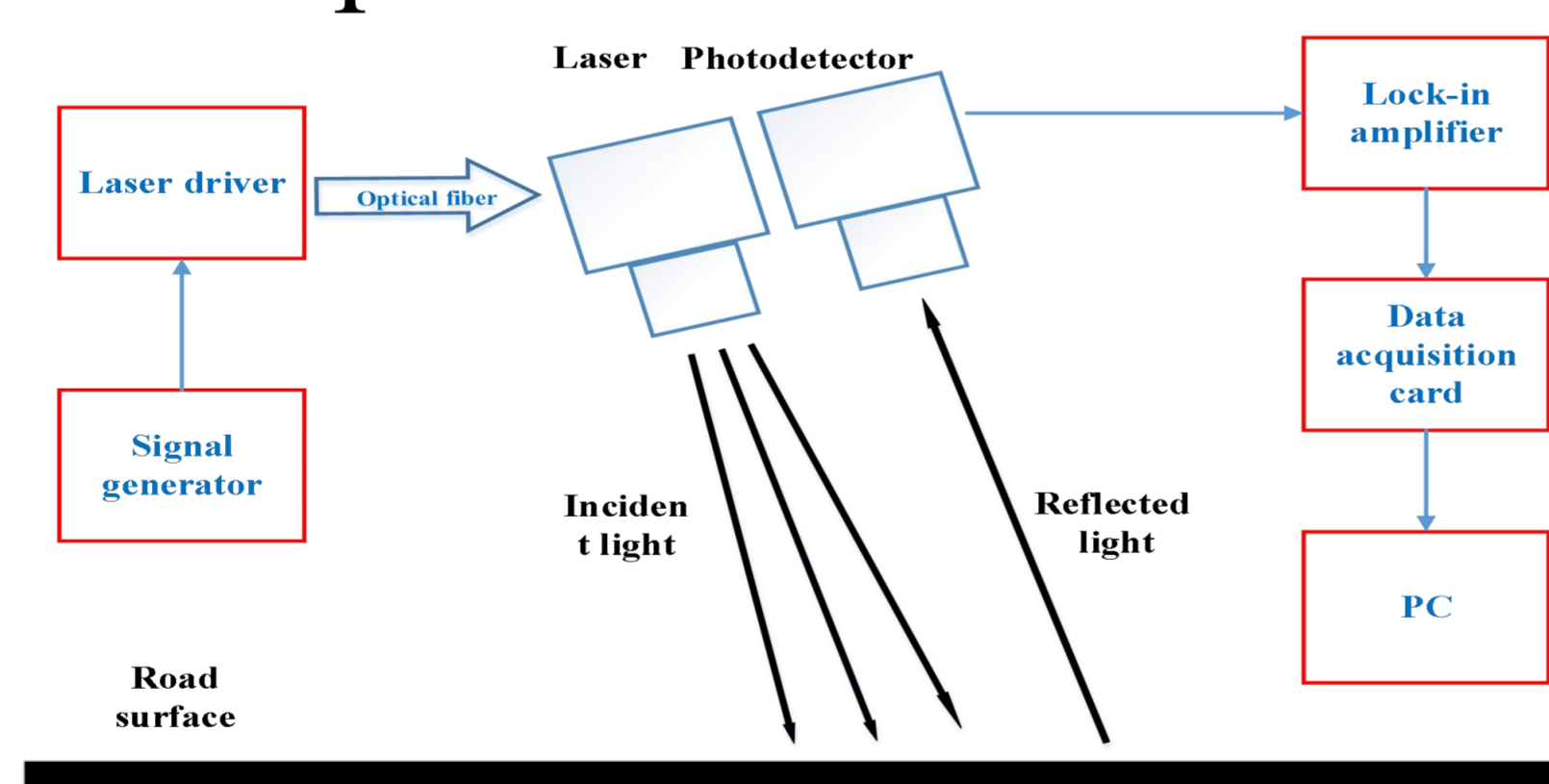


Fig. 1 Structure of road meteorological sensing system.

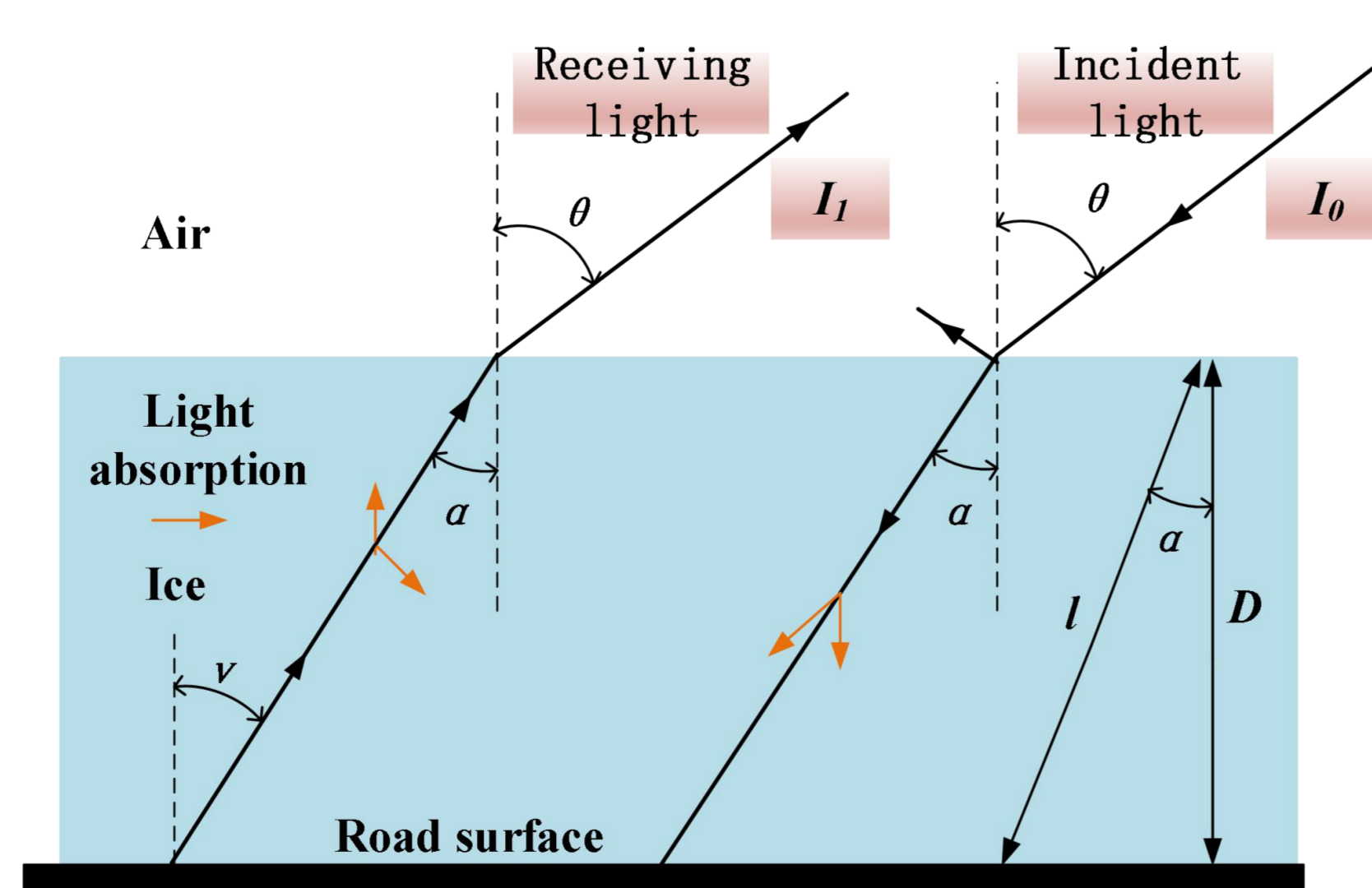


Fig. 2 Propagation of light beam in ice road. I_{ice} is the difference voltage when the road surface begins to freeze under the current water thickness

EXPERIMENT

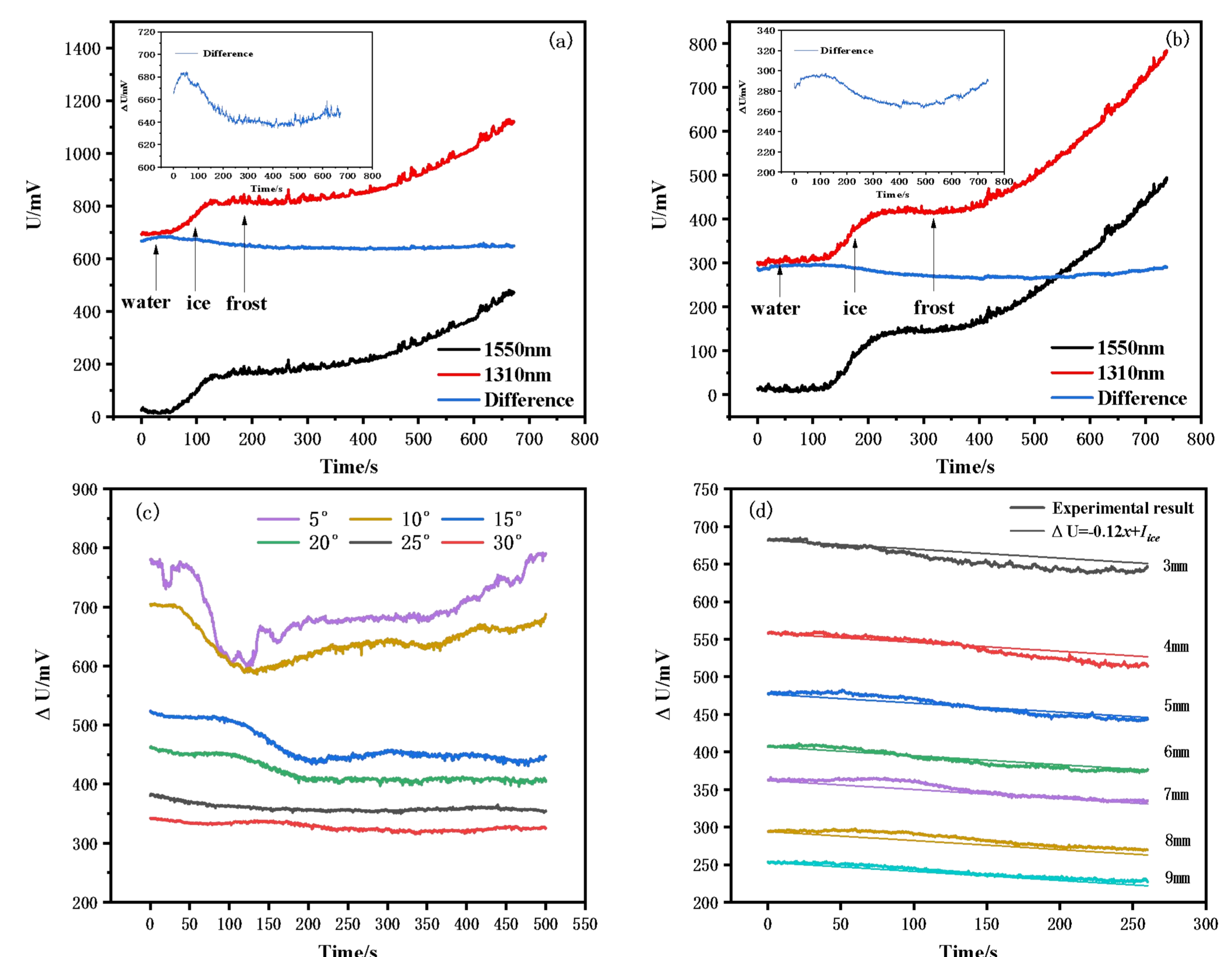


Fig. 3 The whole process of 1310nm and 1550nm laser detection of road icing (a) 3mm (b) 8mm; The relationship between the difference voltage ΔU and duration of ice formation t (c) Different angles (d) Different thickness under detection angle of 25° during the freezing process (260 s).

- $0.95 I_{ice} \sim 1.05 I_{ice}$ is taken as the judgment condition of different ice thickness. I_{ice} is the difference voltage when the road surface begins to freeze under the current water thickness.

CONCLUSION

- The experimental scheme of 1310nm and 1550nm laser is determined by the spectral characteristics of ice;
- The ice thickness measurement algorithm based on difference method is derived;
- Through the study of the theoretical model, the measurement of ice thickness is preliminarily realized.

ACKNOWLEDGEMENT

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