

- Article title: Development of pH Sensor Module with Wireless Transmission Function

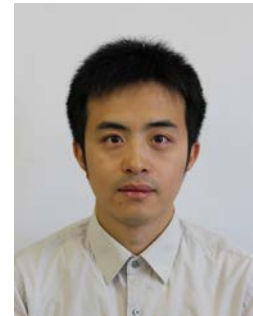
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Lan Zhang received his Ph.D. degree in mechanical engineering from University of Nagoya in 2012. From 2012.4, he worked in National Institute of Advanced Industrial Science and Technology (AIST), Japan as a postdoctoral researcher. He is currently a researcher in Research Center for Ubiquitous MEMS and Micro Engineering (UMEMSME), AIST. His research interests include RF MEMS devices, piezoresistive MEMS devices, low-frequency power harvesting devices and health monitoring MEMS devices.



Development of pH Sensor Module with Wireless Transmission Function

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1. Introduction – Applications and Sensing Electrodes

Sensing system units:

pH electrode on 4-inch Si wafer

Sensing board Transmission board

Case study:
Neonatal health monitoring

After pick up and package

Newborn and his/her diaper

Potential applications:

- Heat stroke monitor
- Urine pH sensor
- Toilet sensor for seniors

Developed pH sensor enjoys the advantages of FET and metal oxide sensing techniques of that:

- ◆ Sensor system can be fabricated with a compact size by getting rid of the reference solution;
- ◆ Sensor structure with an all solid status is fit for long-term pH measurement;
- ◆ Separate sensing electrode can be fabricated with a suitable capture structure for different test environment.

2. Fabrication and Evaluation – Measurement System and Working Characteristics

Sensing electrode only

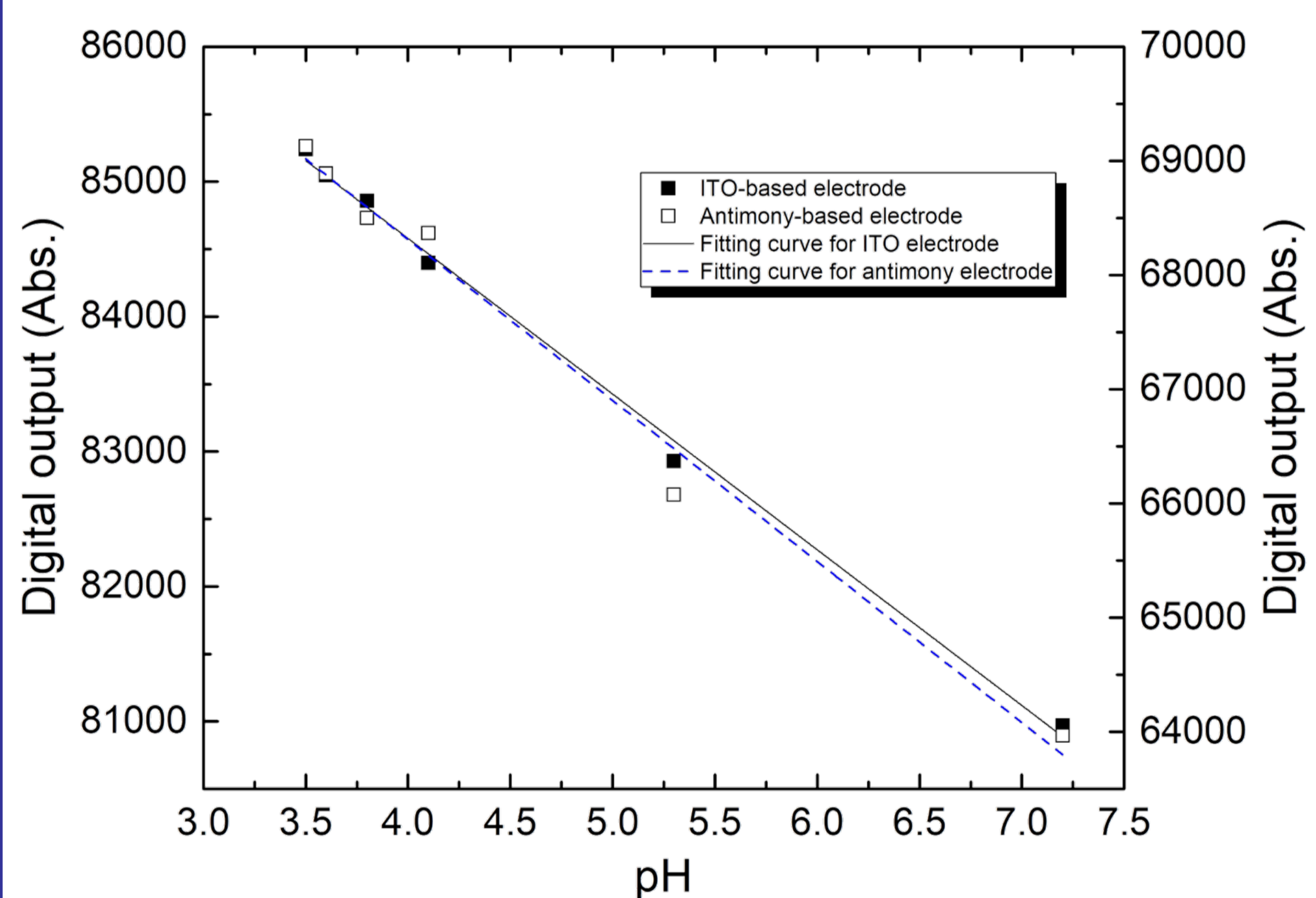
Wireless pH sensor system and its power consumption.

	Ta ₂ O ₅	SnO ₂	ITO
Fabrication	Etching	Etching	Lift-off or etching
pH range	2-11	3-10	4-9
Surface homogeneity (Ra)	2.527 nm	1.229 nm	1.141 nm
Drift	>pH0.1	pH0.05	±pH0.1

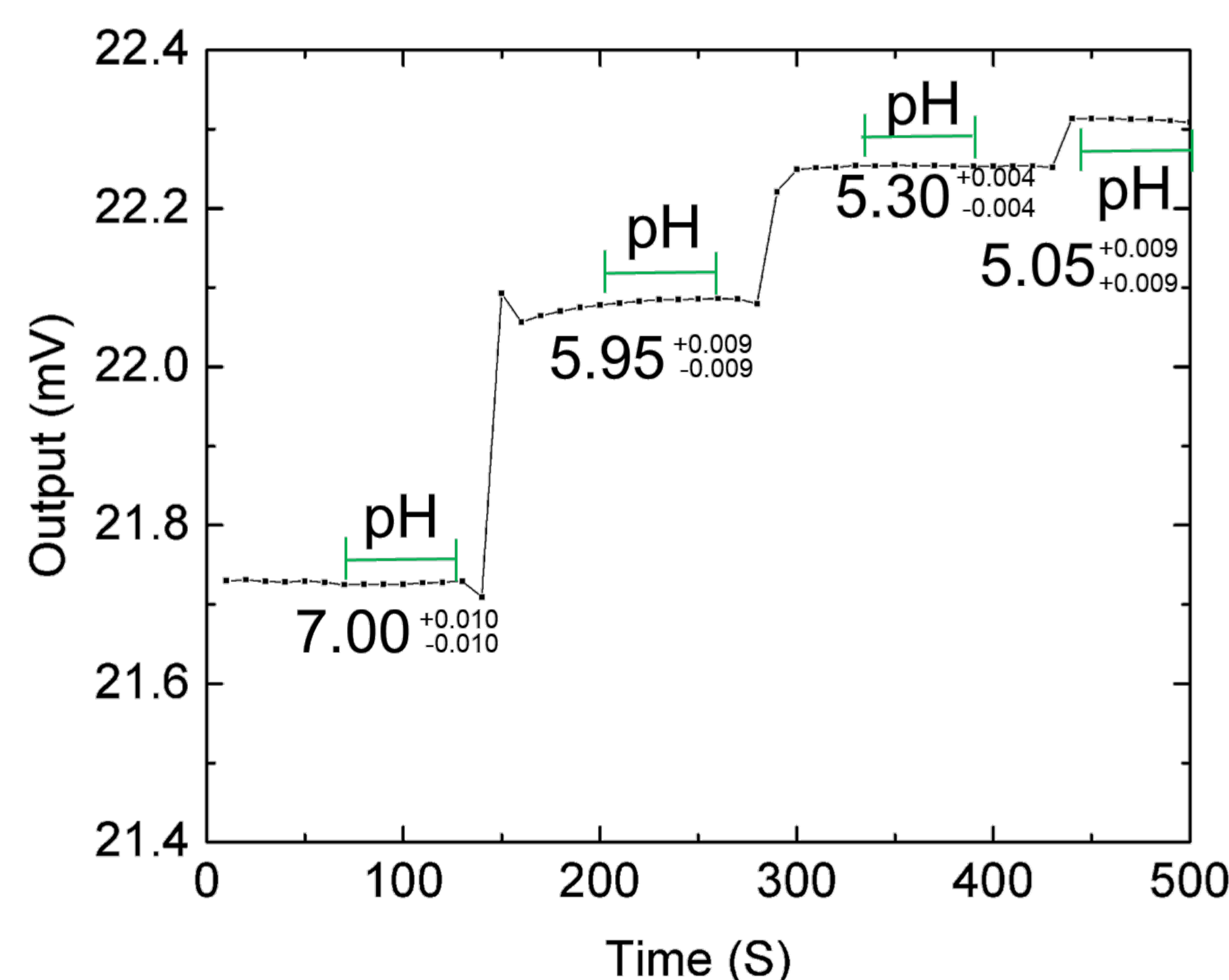
MEMS fabrication sequence of sensing electrode.

Wireless pH sensor system and its power consumption.

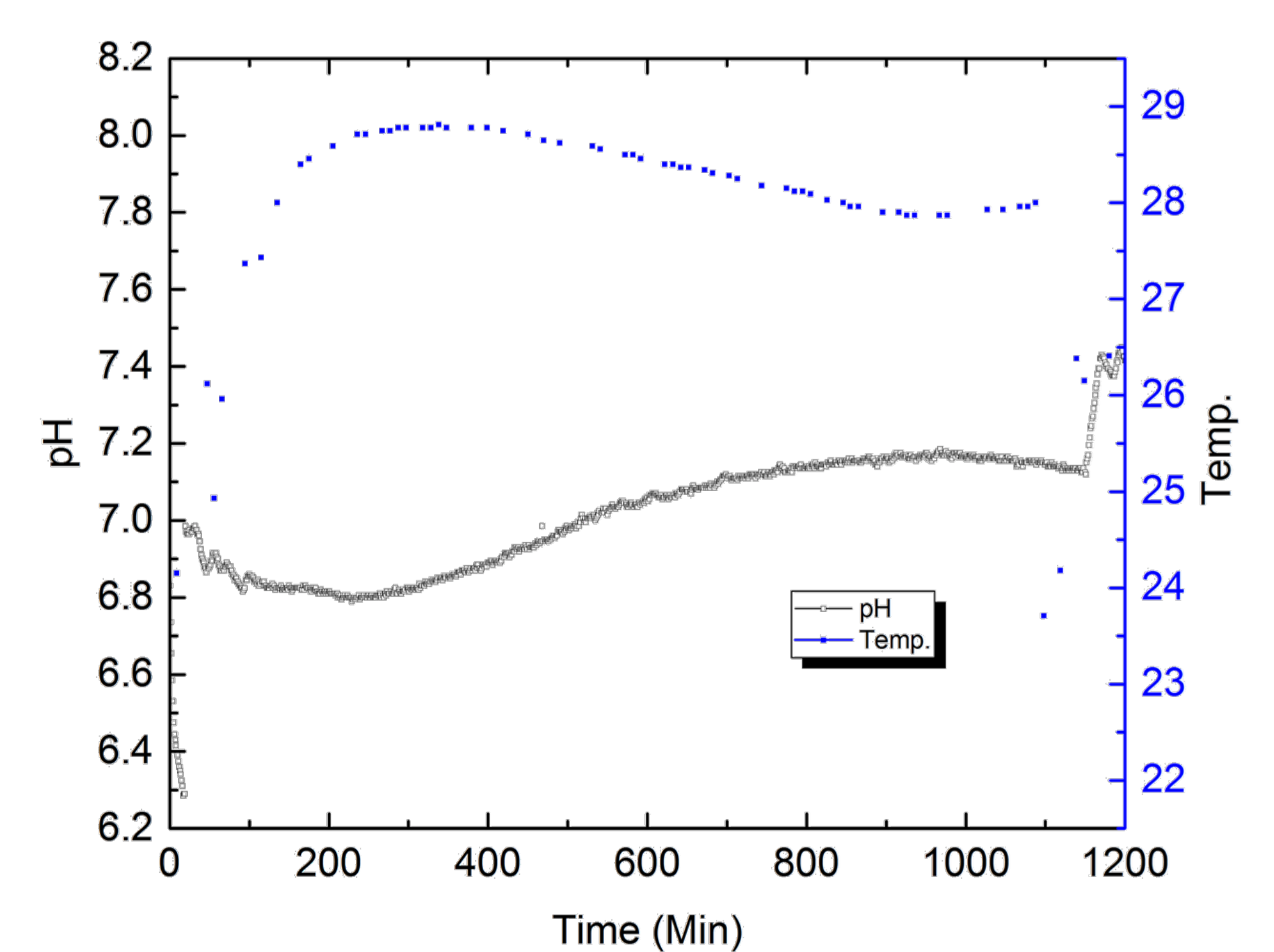
The comparison between the sensing materials.



The output voltage of pH sensor with different sensing electrodes against the measured pH values.



pH sensor output calibration.



Temperature compensation/calibration.

3. Conclusions

- ◆ A solid type pH sensor with compact size and diverse adaptation have been developed.
- ◆ The proposed pH sensor has a relative high sensitivity and enjoys good output linearity.
- ◆ The proposed compact pH system with a wireless transmission function is adequate and it can monitor the urine condition of infants in real time.