INNOVATIVE SENSOR TECHNOLOGY

Platinum thinfilm sensors for space applications

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About Innovative Sensor Technology (IST) AG

- Founded in 1991, headquarter in Ebnat-Kappel, Switzerland
- World-leading manufacturer of thin-film sensors
- International: More than 150 employees,
  Assembling facility in Czech Republic, sales office in US
- Broad product range: temperature sensor, humidity sensor, flow sensor, conductivity sensor, gas sensor etc.
- 100% subsidiary of Endress+Hauser Group
- New Building in 2012 with 400 m^2 clean room

Outline

- Requirements for space applications
- Introduction: Thin-film sensors
- IST AG core technology
- PW Technology
- Summary

Requirements for space applications

- High precision and long-term stability
- Wide temperature range
- Excellent vibration resistance
- Shock resistant
- Very low hysteresis
- Outgassing free
- Radiation hardened
- Compact and lightweight

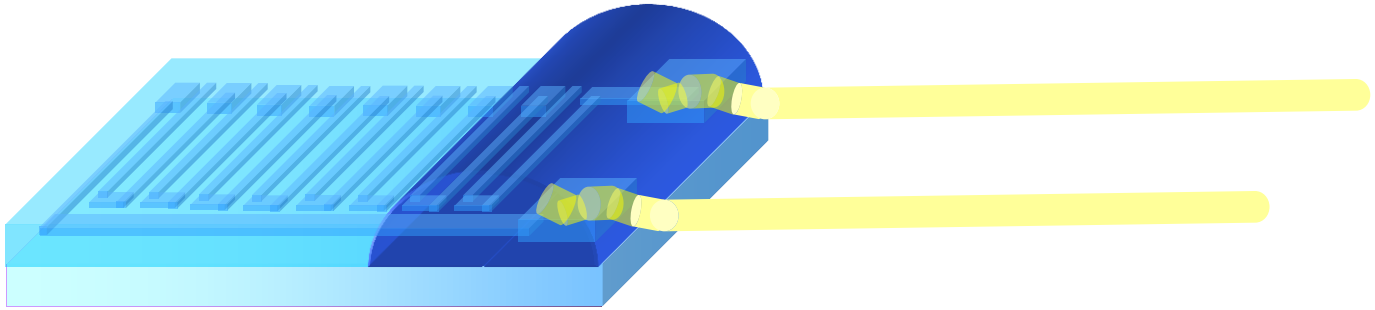
Thin-Film Sensors

Structure

- Ceramic substrate
- Sensitive structure
- Passivation layer
- Connection
- Fixing of the wires

Advantages

- Small dimensions
- Short response time
- Long term stability
- High electrical insulation
- Radiation hardened



INNOVATIVE SENSOR TECHNOLOGY

IST Core Technologies

Thin Film Deposition

- RF Diode / DC Magnetron Sputtering
- High Vacuum Evaporation

Lithography and patterning

- Spin Coating
- Double Side Mask Aligner
- Ion Etching System

Trimming / Passivation

- Full Automatic High Speed Laser Trimming
- Screen Printing Passivation
- Belt Furnaces

Produced in class 1000 clean room in Switzerland

INNOVATIVE SENSOR TECHNOLOGY

IST Core Technologies (2)

Assembly

- High Speed Dicing
- Automatic Welding
- 100% End Of Line Test

Test & Measurement

- Automated Measurement
- Optical Inspection
- Mechanical Test

Calibration Laboratory

- Internal Reference Standards
- Traceable Equipment

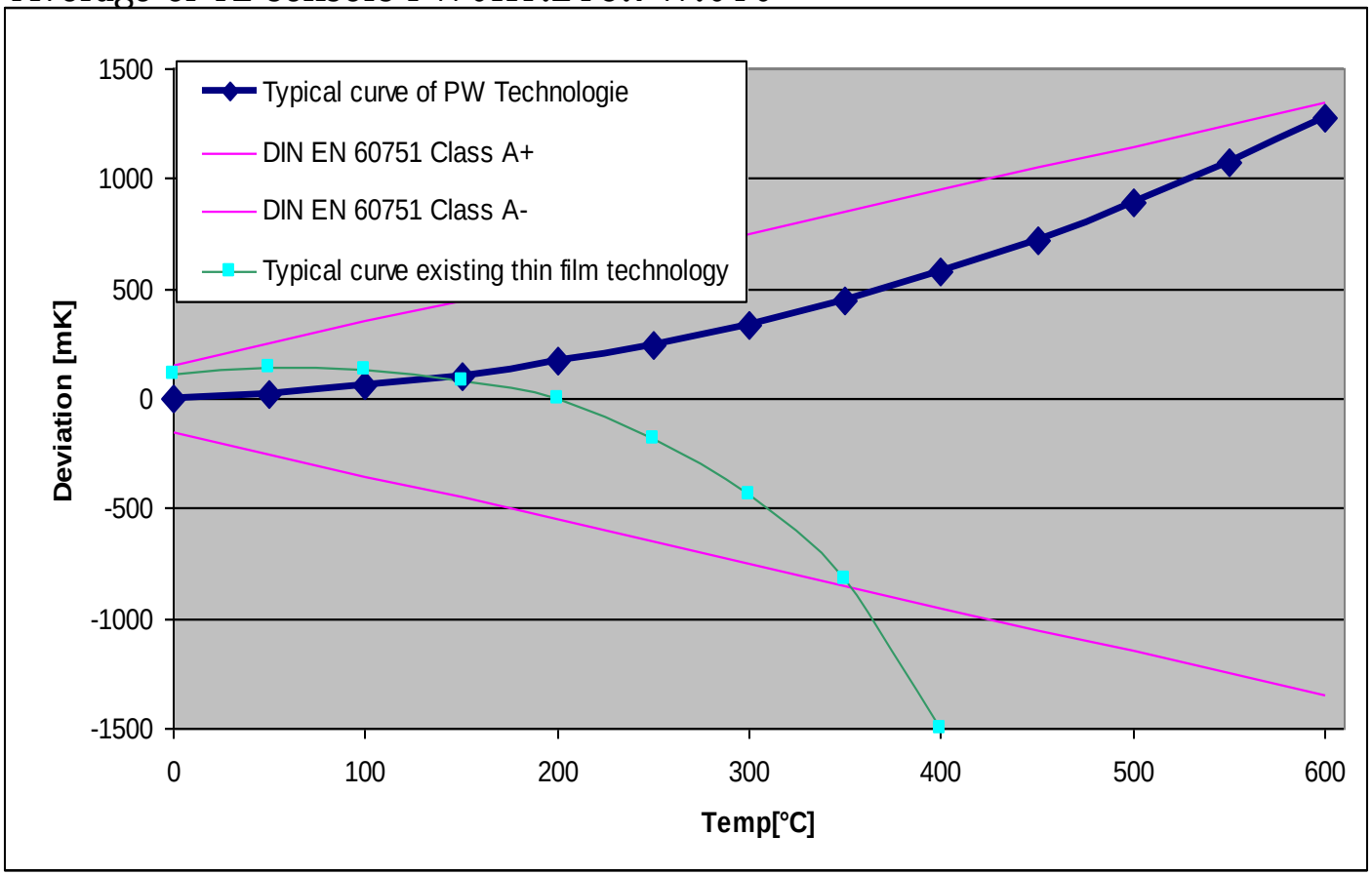
Produced in Switzerland and Czech Republic

PW Technology

- Motivation: 100% interchangeable with wire wound sensors
- Wide temperature range
- Low hysteresis

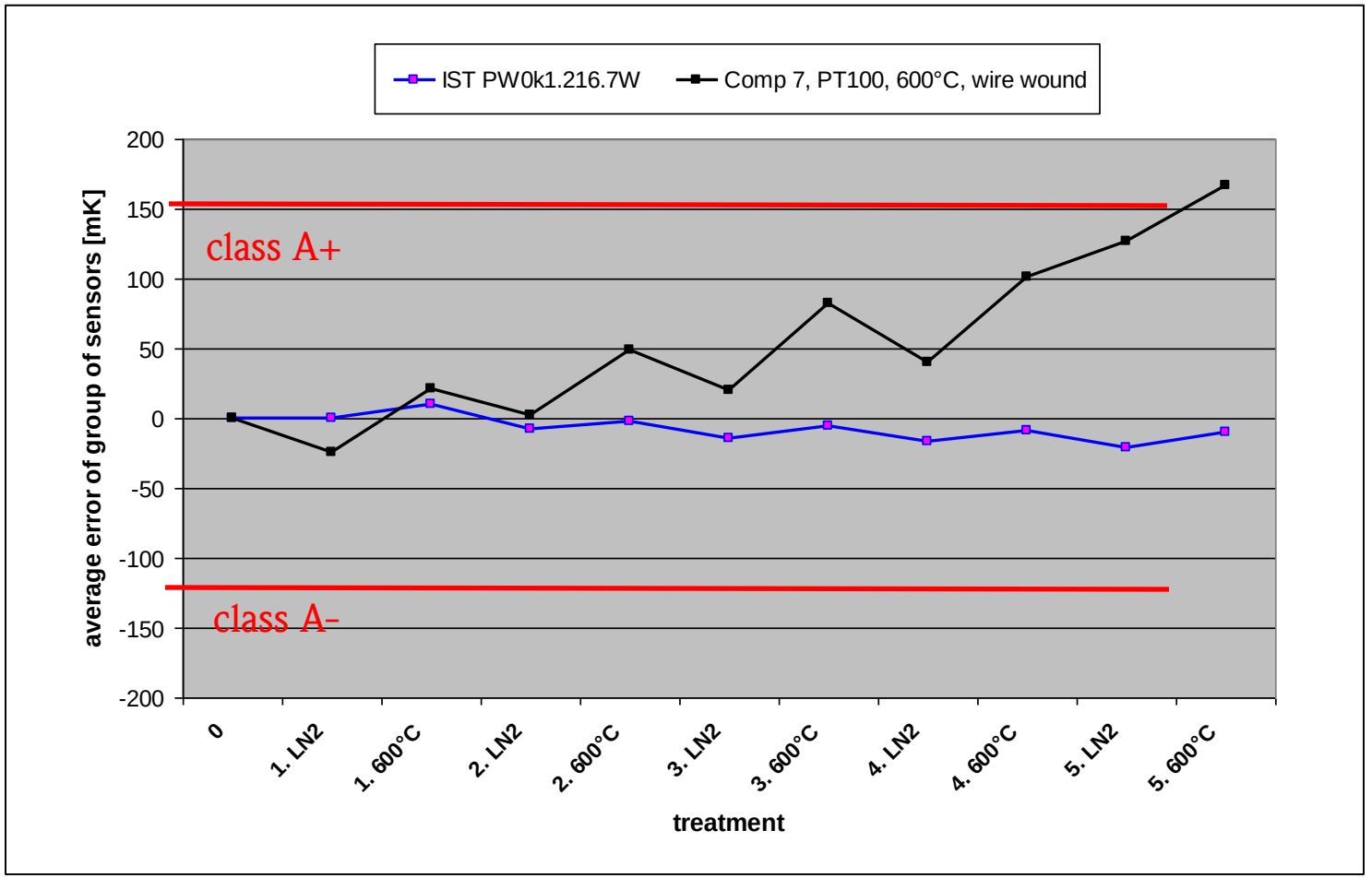
PW: High accuracy within calss A

Average of 12 sensors PW0K1.216.7W.010



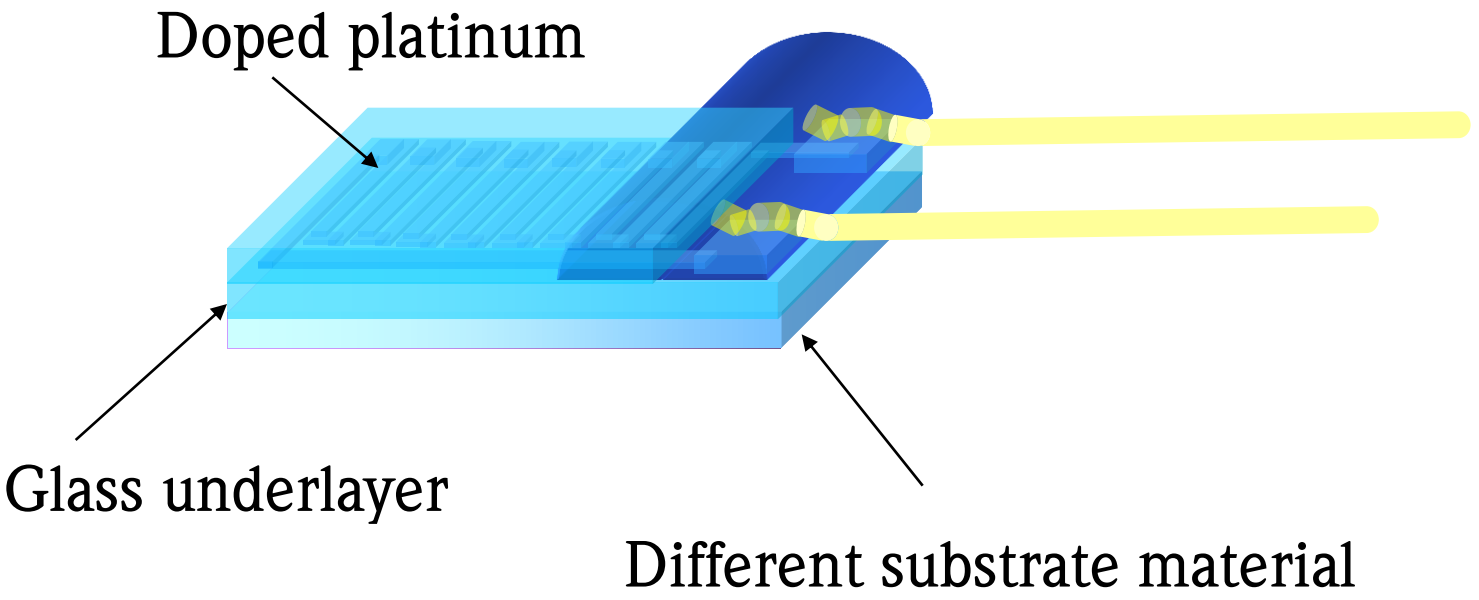
Temperature range up to 600°C in class A

PW: Hysteresis liquid Nitrogen and Oven (600°C)



Significantly less hysteresis

PW: Technology improvements



IST PW Technology

Special feature:	really true DIN 60751 curve
Temperature range class A:	-200°C up to +600°C
Short term (< 1 hour, one time)	up to +750°C
Dimension:	2.5mm x 1.6mm
Temperature coefficient: :	3850ppm/K
Norm:	DIN IEC 60751

Classes in 1/3 DIN B, 1/5 DIN B or 1/10 DIN B on request

Technology Applications

Temperature stabilization:

- Combination of heater and sensor
- Fast response
- Very precise

Flow sensors:

- Cooling effect depends on flow velocity
- Very sensitive
- Fastest response with polyimide substrate

Gas, conductivity and humidity sensors

Customer specific Design-in Process

- Strength of IST for more than 20 years
- Extended to specific needs for space customers
- Platform:
  - High volume process stability
  - High flexibility with platform building blocks
  - Integration of thermo sensor, heater and flow sensor
  - Special trimming for uniformity of heater
  - Non-Standard TCR
  - Wiring and packaging

Customer specific Design-in Process (2)

- Know-how for engineering support:
  - Deep technology understanding
  - Reliability and failure analysis
  - Packaging
  - Flow channel optimization
  - Fully equipped test lab

Customer specific Design-in Process (3)

- Quality management:
  - Detailed specifications
  - Detailed process documentation and records
  - Qualification Test Programme (QTP)
  - Acceptance Test Procedure (ATP)
  - Change management with customer involvement and approval
  - Continuous improvement

Test Lab competence

- Accurate temperature and resistance measurement
- +/- 5 mK uncertainty
- +/- 0.6 mΩ uncertainty @100Ω
- Burn-in, accelerated aging
- Sophisticated measurement: pads not touched

Tests according to ESCC No. 4006

- Production tests (Chart II)
- Burn-in (Chart III)
- Qualification tests (Chart IV)
- Lot acceptance (Chart V)

- Extensive test
- Simplified customer specific QTP, ATP, LAT can be derived

Summary

- Technology well suited for space applications
- Limitations eliminated with PW technology
- Well controlled mass production
- Made ready for space applications
- Engineering support
- Investment in clean room

INNOVATIVE SENSOR TECHNOLOGY

Outstanding Invention

for sensors in thin film technology

High precision and wide temperature range

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