

Metal Temperature Measurement Technologies

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Abstract: *Discovery of Metals was one of the greatest achievements for humans. From the discovery to until now metals are used in almost every industry, we are surrounded by a metallic world. Metal temperature measurement is an integral part of many industrial operations. Accurate temperature measurement is very important for safety, process efficiency and product quality. Depending on the specific application and desired temperature, the industry uses many technologies to control metal temperature. In many industrial operations, including metal forming, heat treatment, and welding, accurate and consistent metal temperature measurement is crucial. An overview of the numerous temperature sensors used in industry and the most current developments in metal temperature measuring technology are provided in this review paper*

Keywords: Temperature measurement, thermocouples, contact temperature sensors, non-contact temperature sensors, industry

REFERENCES

- [1] J.R. Deepak, M. Prasanna Kumar, M. Nithishkar, Review on temperature monitoring system for welding application – A case study on thermocouple array, *Materials Today: Proceedings*, 2023.
- [2] D. Pan, Z. Jiang, Z. Chen, W. Gui, Y. Xie and C. Yang, "Temperature Measurement and Compensation Method of Blast Furnace Molten Iron Based on Infrared Computer Vision," in *IEEE Transactions on Instrumentation and Measurement*, vol. 68, no. 10, pp. 3576-3588, Oct. 2019, doi: 10.1109/TIM.2018.2880061.
- [3] D. Li, S. Joshi, J. -H. Kim, and S. Ogreneci-Memik, "End-to-End Analysis of Integration for Thermocouple-Based Sensors Into 3-D ICs," in *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, vol. 25, no. 9, pp. 2498-2511, Sept. 2017.
- [4] Ross-Pinnock D, Maropoulos PG. "Review of industrial temperature measurement technologies and research priorities for the thermal characterisation of the factories of the future". *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*. 2016;230(5):793-806.
- [5] A. Kus, Y. Isik, M. C. Cakir, S. Coşkun, and K. Özdemir, "Thermocouple and Infrared Sensor-Based Measurement of Temperature Distribution in Metal Cutting," *Sensors*, vol. 15, no. 1, pp. 1274-1291, 2015.
- [6] Mei Z, Maropoulos PG. Review of the application of flexible, measurement-assisted assembly technology in aircraft manufacturing. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*. 2014;228(10):1185-1197.
- [7] D. Ross-Pinnock and P. G. Maropoulos, "Identification of key temperature measurement technologies for the enhancement of product and equipment integrity in the light controlled factory," *Procedia CIRP*, vol. 25, pp. 114-121, 2014.
- [8] T. J. Bajzek, "Thermocouples: a sensor for measuring temperature," in *IEEE Instrumentation & Measurement Magazine*, vol. 8, no. 1, pp. 35-40, March 2005
- [9] W. A. Wakeham and R. Peralta Martinez, "Molten Metals: A Challenge for Measurement," *Journal of Thermal Analysis and Calorimetry*, vol. 65, no. 2, pp. 363-376, 2001.
- [10] J. James, R. Spittle, A. Brown, and P. Evans, "A Review of Measurement Techniques for the Thermal Expansion Coefficient of Metals and Alloys at Elevated Temperatures," in *Journal of Materials Science*, vol. 36, no. 7, pp. 1685-1701, 2001.

- [11] P. R. N. Childs, J. R. Greenwood, and C. A. Long, "Review of temperature measurement," Review of Scientific Instruments, vol. 71, no. 8, pp. 2855-2978, 2000.
- [12] D.D. Pollock, "The Theory and Properties of Thermocouple Elements.(ASTM Special Technical Publication 492) Stamford, CT:Omega Press, 1979,pp.1-23
- [13] D. A. Stephenson, "Tool-Work Thermocouple Temperature Measurements—Theory and Implementation Issues," Journal of Engineering for Industry, vol. 115, no. 4, pp. 432-438, 1993.