FABRICATION OF FLEXIBLE THERMOCOUPLE BY LASER INTEGRATION OF CONDUCTIVE MATERIALS

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Fabrication of flexible temperature sensors is in demand due to the wide range of its application from soft robotics and flexible electronics to healthcare[1]. Temperature sensing mechanism, in general, can be based on changing two parameters with the temperature: resistance and contact potential. Resistance temperature sensors (RTDs) have a simple working principle which is based on resistance growth with the temperature and generally made of metals with stable and well-known R(t°) characteristics. These kinds of sensors require a power source and resistance measurement circuit. In contrast, thermocouples are passive temperature sensors whose working principle is based on contact potential difference changing with the temperature. Its added benefit is lower sensitivity to strain as compared to RTDs.

In this work a method of flexible thermocouple fabrication is demonstrated. Using a laser integration method we've achieved an integration and temperature sensing with copper and nickel nanoparticles integrated in polyethylene terephthalate (PET). Experimentally acquired sensitivity of Cu/Ni flexible thermocouples was calculated as ~21 μV/K (Fig.1) which is as good as commercially available metal-based thermocouples. Further optimization of sensitivity by using different materials and dopants could allow us to achieve better sensitivity for the following use in a wide range of applications.

REFERENCES

[1] Flexible temperature sensors: A review // Sens. Actuators A Phys. Elsevier, 2020. Vol. 315. P. 112282, doi:10.1016/j.sna.2020.112282.