A highly-Stretchable yet strain-insensitive temperature sensor exploiting Seebeck effect in nanoparticle-based printed circuits

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ABSTRACT

Stretchable temperature sensors are critical components in soft robotics. Most of existing temperature-sensing technologies feature a strong coupling between the responses to temperature and to the deformation of the measured object, resulting in strain-polluted temperature measurement. We leverage here the Seebeck effect in nanoparticle-based printed circuits. Using nanoparticle-based circuits as conductive wires provides the stretchability. While a resistive measurement would be highly perturbed by strain variations, using the Seebeck-induced change in voltage makes the measured signal insensitive to strains. Two nano structured wires made of different materials are printed and embedded in a soft polymeric film to form a micro thermocouple. This temperature sensor shows good stretchability up to 40%, high linearity of the response and excellent repeatability between different samples.

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