Grid Patterned Metal Strain Sensor with Ultrahigh Sensitivity Based on Solution Process

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Strain gauge has drawn attentions for its versatility on healthcare, soft robot, and human-robot interface. Despite of large potential demands, traditional semiconductor or metal-based strain sensors have a limitation of stretchability ($\varepsilon \leq 2$ %). Extensive studies have been proposed for stretchable deformation sensors with various materials such as graphene, carbon nanotube, graphite, metal nanowires, metal nanoparticles, liquid metal, ionic liquid, metal film. However, it is still challenging to satisfy properties of sensitivity, stretchability, linearity, hysteresis, applicability to mass production. Herein, we propose grid structural metal strain sensor. We investigated the effects of width and width/spacing ratio of the metal grid on piezoresistivity of the strain sensors. Our strain sensors exhibit high sensitivity (GF = 4685.9 at 5 % strain), superior strain range ($\varepsilon \leq 5$%) compared to other metal-based sensors, fast response time ($\approx$ 18.6 ms), and low hysteresis (DH = 11.68). In addition, our metal grid strain sensors can be produced with eco-friendly and low-cost procedure, due to all water-based solution process.