Supplementary Material for

Strain-sensitive electrical conductivity of carbon nanotube-graphene-filled rubber composites under cyclic loading

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S1. The supplementary figures

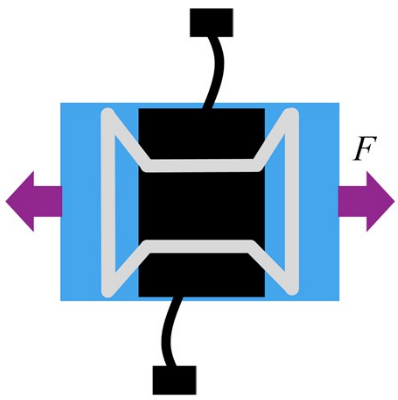

Fig. S1. The relative smaller negative Poisson's ratio structure design to realize the regulation of the resistance response for the large sheet of CNT/graphene RTV rubber composites.

S2. The finite element analysis for the negative Poisson's ratio structures

The numerical model for negative Poisson's ratio conductive sensing structures has been established, as shown in Fig.S2. The geometric dimensions in the three-dimensional numerical model are consistent with the samples size in the experiments.

The Yeoh model has been used to characterize the hyperelastic behavior for the rubber materials and the test data in Fig.S3 was adopted to obtain the material parameters. The 30% nominal strain was applied in the horizontal direction. The first-order hybrid reduced integral element (C3D8RH) was selected for the model. Convergence of the computation and the grid independence have been guaranteed by comparing the present results with those calculated using a refined mesh.

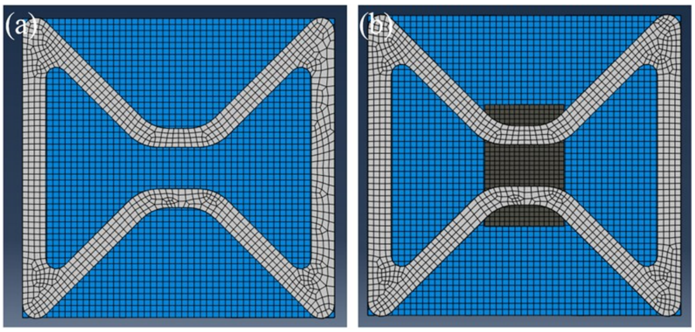

Fig.S2 The numerical model for negative Poisson's ratio conductive sensing structures: (a) negative Poisson's ratio structure. (b) negative Poisson's ratio structure with sensing element.

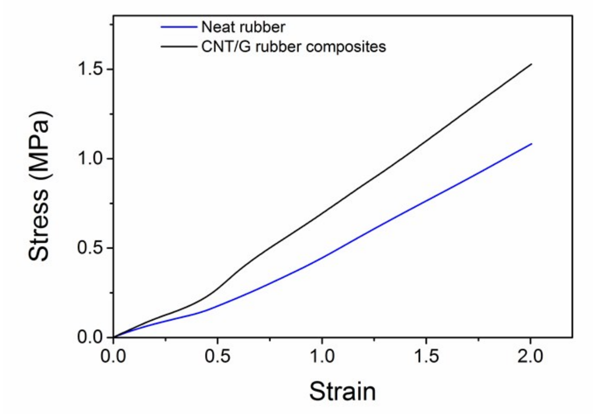

Fig.S3 Stress-strain curve of flat neat RTV silicone rubber and 4.0 wt% CNT/graphene RTV silicone rubber conductive composites with stretchability of 200%.

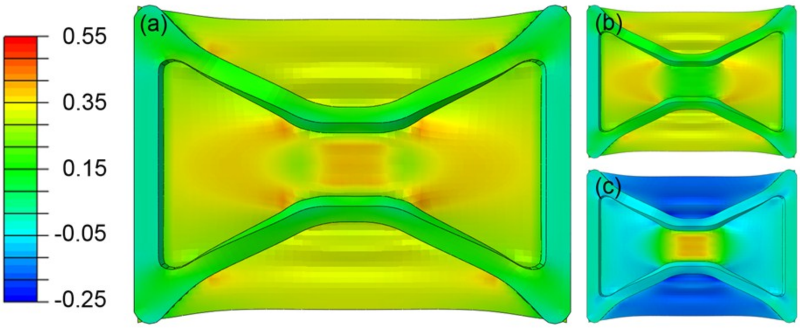

Fig.S4 Strain distribution from FEM simulation under 30% nominal strain for the negative Poisson's ratio structure: (a) Strain, Max.Principal. (b) ε_{11}. (c) ε_{22}.

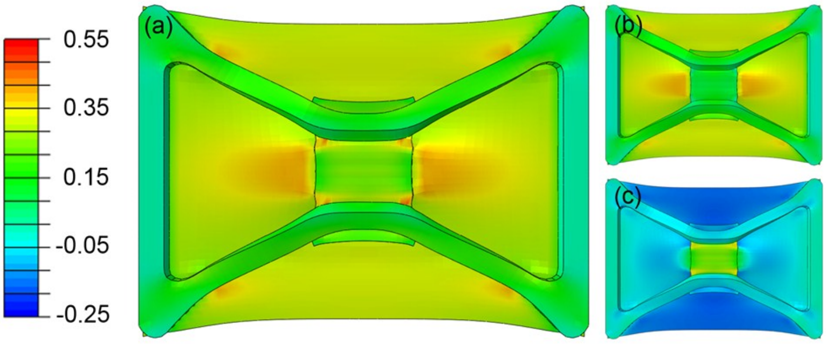

Fig.S5 Strain distribution from FEM simulation under 30% nominal strain for the negative Poisson's ratio structure with sensing element: (a) Strain, Max.Principal. (b) ε_{11}. (c) ε_{22}.