Supplementary information

Triple shape memory, magneto-response, and piezo-resistive flexible composites: multiple-sensing and switchable actuating

Tao Hu,[a] Shouhu Xuan,*[a] Quan Shu,[a] Zhenbang Xu,[b] Longjiang Shen,[c] Jun Li,[d]

Xinglong Gong,*[a]

[a]*CAS Key Laboratory of Mechanical Behavior and Design of Materials, Department of Modern Mechanics, CAS Center for Excellence in Complex System Mechanics, University of Science and Technology of China, Hefei 230027, PR China*

[b]*CAS Key Laboratory of On-orbit Manufacturing and Integration for Space Optics System, Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, Changchun 130033, Jilin, China*

[c]*Hunan Bogie Engineering Research Center, Zhuzhou 412000, Hunan, China*

[d]*Anhui Weiwei Rubber Parts Group Co.Ltd., Tongcheng 231400, Anhui, China*

**Corresponding author: Tel: 86-551-63600419.*

E-mail: gongxl@ustc.edu.cn (XL Gong); xuansh@ustc.edu.cn (SH Xuan).

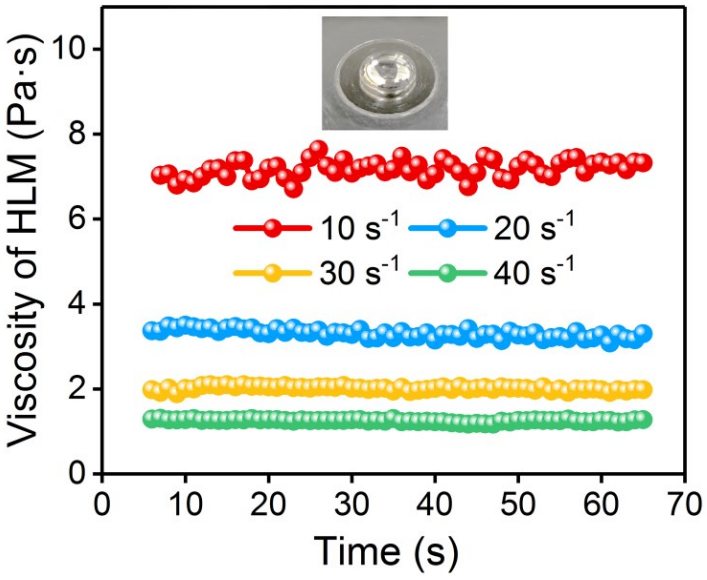

Fig. S1 The viscosity of the high temperature liquid metal (HLM) at 60℃.

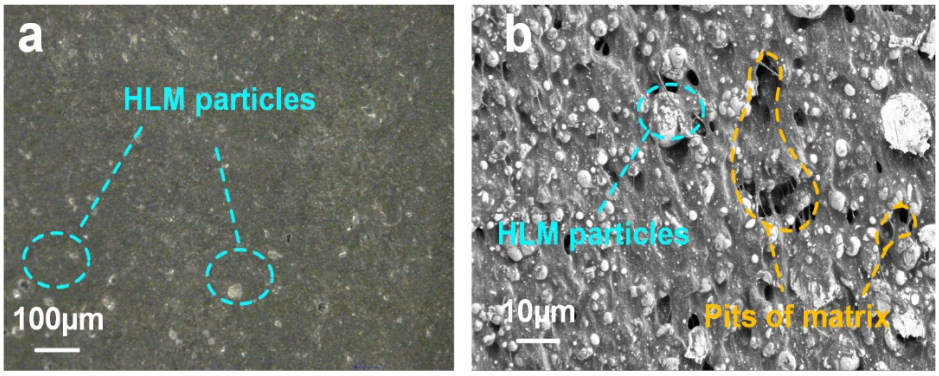

Fig. S2 (a) Digital microscopy of PPLC surface and (b) enlarged SEM images of PPLC cross section.

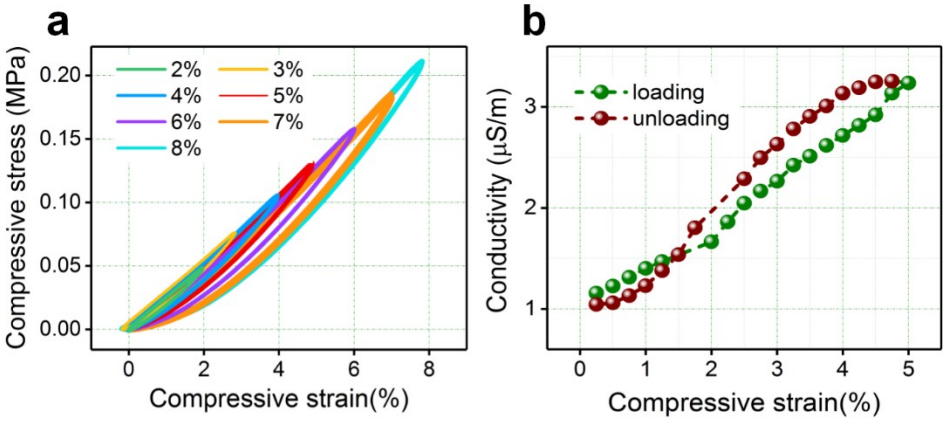

Fig. S3 (a) The compressive stress versus compressive strain at 0.5 Hz and various amplitude; (b) the resistance changes versus compressive strain in loading and unloading phases.

The variation of compressive stress showed the low hysteresis of mechanical responding for PPLC sensor at room temperature (**Fig. S3**a). The hysteresis loop showed the low plasticity of PPLC sensor at the room temperature. The $\Delta\sigma/\sigma_0$ versus compressive strain for the loading and unloading phases with the amplitude of 5% also have shown the low hysteresis of PPLC sensor (**Fig. S3**b). The variation tendency of compressive stress was consistent in each cycle, which represented the good repeatability.

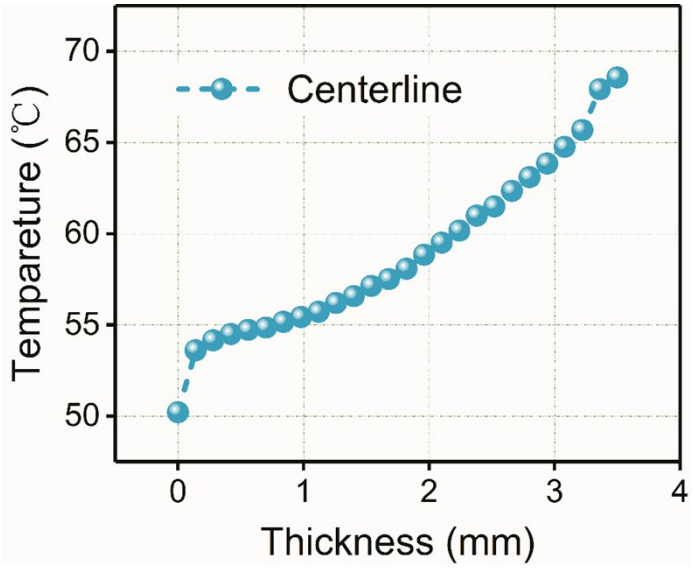

Fig. S4 The corresponding temperature variation along the centerline of PPLC sensor during the real-time monitoring process.

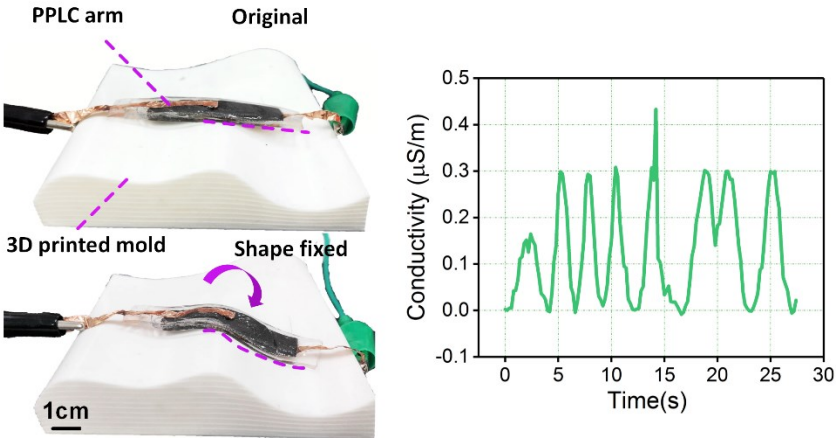

Fig. S5 The self-adaptive sensing and shape memory process of PPLC arm on a 3D-printed mold and corresponding conductivity variation.