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Self-healing thermoplastic polyurethane (TPU)/polycaprolactone (PCL) /multi-wall carbon nanotubes (MWCNTs) blend as shape-memory composites

Xiaohui Xu[1], Peidong Fan[1], Jia Ren[1,2], Yu Cheng[1], Junkai Ren[1], Jun Zhao[2]* , Rui Song[1]**

[1] School of Chemical Sciences, University of Chinese Academy of Sciences, Beijing 100049, 19A, Yuquan Road, Beijing, 100049 China

[2] CAS Key Laboratory of Nanosystem and Hierarchical Fabrication, CAS Center for Excellence in Nanoscience, National Center for Nanoscience and Technology, Beijing 100190, China

Corresponding author: zhaoj@nanoctr.cn (J. Zhao), rsong@ucas.ac.cn (R. Song)

Abstract： Polymer blends with self-healing capability when damaged have received increasing interests and have been developing rapidly because of their many potential applications. Here, the polymer blend comprising of thermoplastic polyurethane (TPU) and polycaprolactone (PCL) as shape memory matrix was initially prepared by melting blending, and then the multiwalled carbon nanotubes (MWCNTs) were incorporated to endow the blend with excellent self-healing property in the presence of near infrared (NIR) irradiation (808 nm, 0.14 W). Compared with the traditional heat-induced self-healing shape memory composites, NIR irradiation could not only reduce the healing time, but also can selectively repair the exposed damaged regions without distinct interference to the performance of surrounding parts. As revealed, these composites presented superior shape memory and self-healing behavior in the presence of NIR irradiation. Specifically, the blend containing 50% TPU, 50% PCL and 3 MWCNTs (U1C1-3) possesses shape memory properties as manifested by a ca. 96.8% shape fixing ratio (R_f) and ca. 63.9% shape recovery ratio (R_r). The surface crack and scratches can be completely recovered in 3 min NIR irradiation. And moreover, this NIR stimulated self-healing could performed repeatedly for at least