Supplementary Information

Synthesis of nanosensors for autonomous warning of damage and self-repairing in polymeric coatings

Chengbao Liu[a,b], Zhengyu Jin[a], Li Cheng[a], Haichao Zhao[,a] and Liping Wang[*,a]*

[a] Key Laboratory of Marine Materials and Related Technologies, Zhejiang Key Laboratory of Marine Materials and Protective Technologies, Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Ningbo 315201, China.

[b] University of Chinese Academy of Sciences, Beijing 100049, China

Corresponding authors: wangliping (wangliping@nimte.ac.cn)

zhaohaichao (zhaohaichao@nimte.ac.cn)

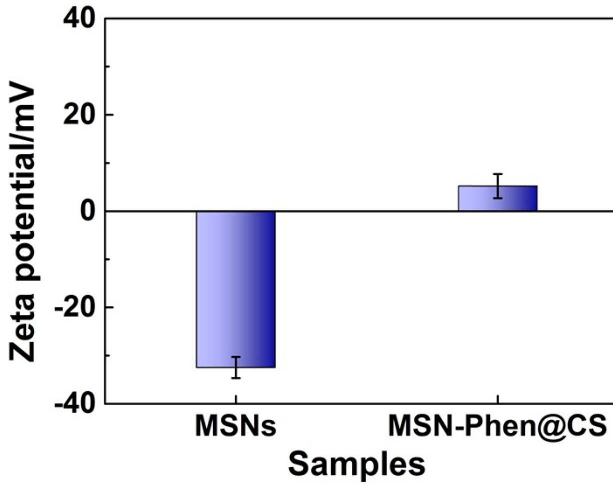

Fig. S1 Zeta potential of MSNs and MSN-Phen@CS.

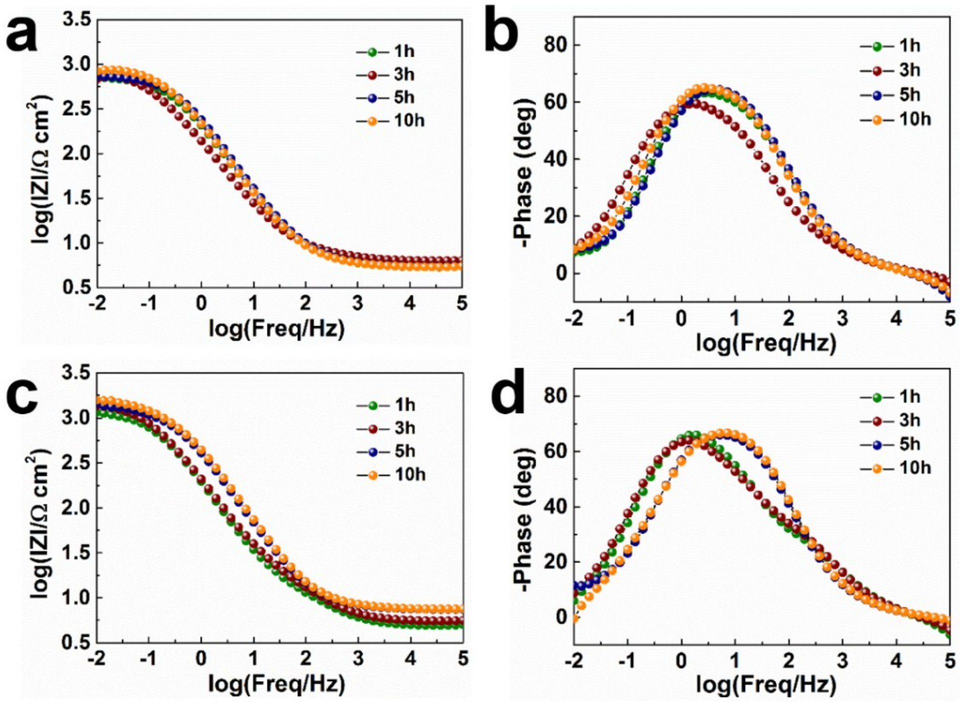

Fig. S2 Bode plots showing the impedance and phase angle as a function of frequency immersion in 3.5 wt% NaCl of steel electrodes, (a) (b) without nanosensors, (c) (d) with nanosensors.

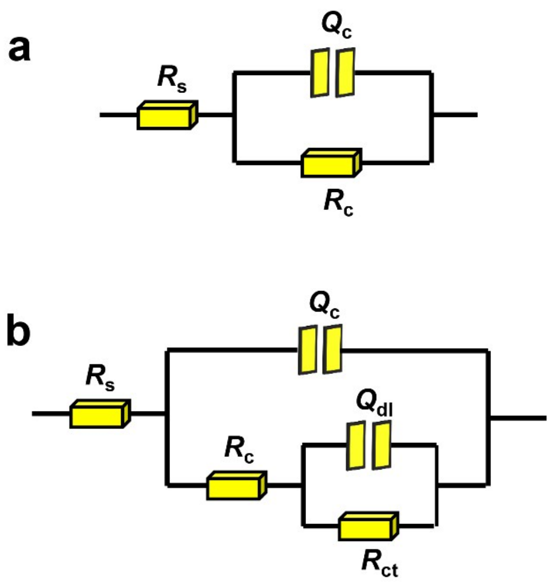

Fig. S3. The corresponding equivalent electric circuits used for EIS analysis.

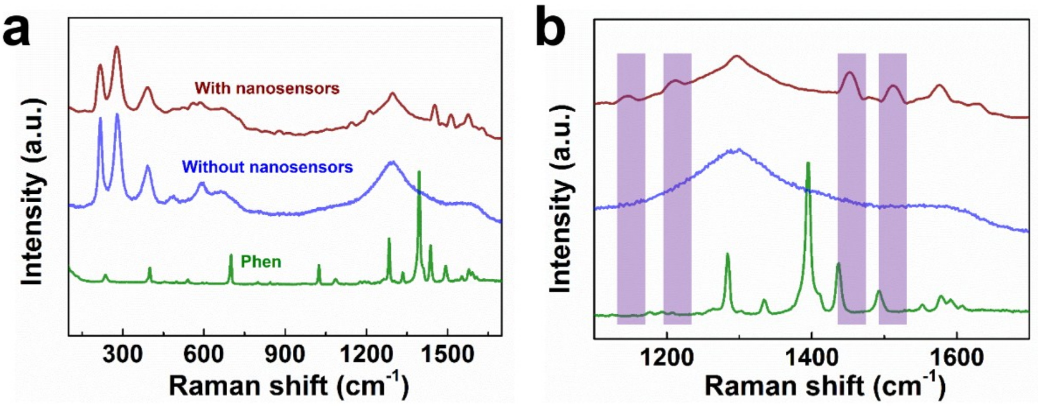

Fig. S4 Raman spectra of Phen, steel electrodes after 10 h immersion in 3.5 wt% NaCl solution with and without nanosensors.

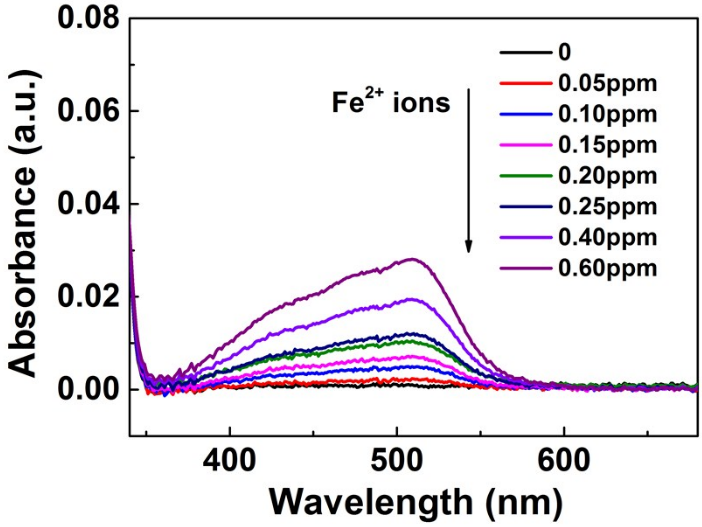

Fig. S5 UV-Vis absorption of Phen before (0, black line) and after adding different concentration of Fe^{2+} ions.

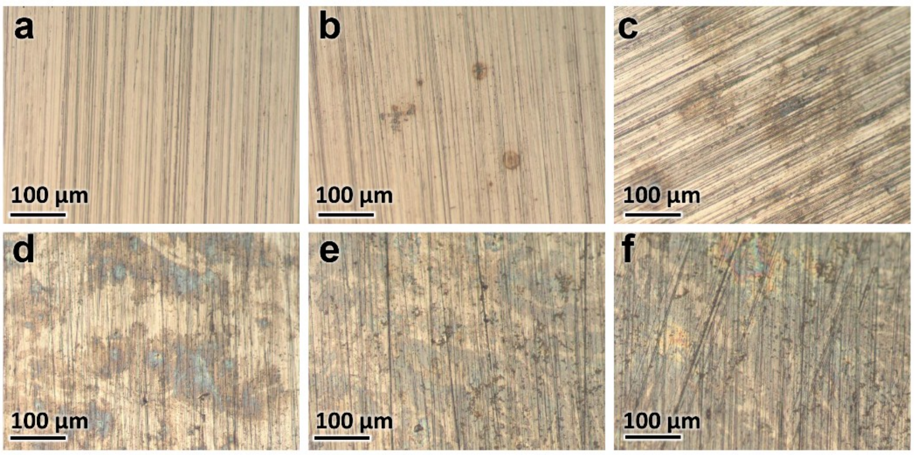

Fig. S6 Optical micrograph of steel electrodes immersed in 3.5 wt% NaCl solution for (a) 0 min, (b) 5 min, (c) 10 min, (d) 30 min, (e) 60 min and (f) 120 min.

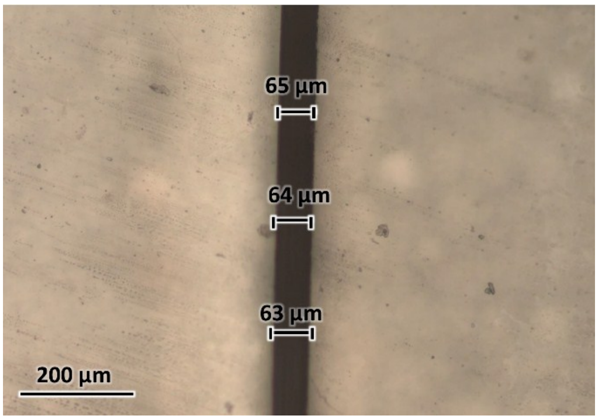

Fig. S7 Optical micrograph of composite coating with a defect.

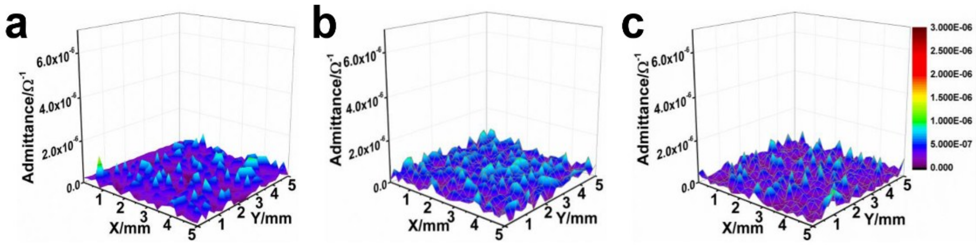

Fig. S8 LEIS maps around the artificial damage for steel electrodes coated with (a) neat epoxy, (b) MSN-Phen@CS$_{1\ wt\%}$/epoxy and (c) MSN-Phen@CS$_{2\ wt\%}$/epoxy coatings without immersion.