Supporting Information

In situ polymerization of sulfonated polyaniline in layered double hydroxide host matrix for corrosion protection

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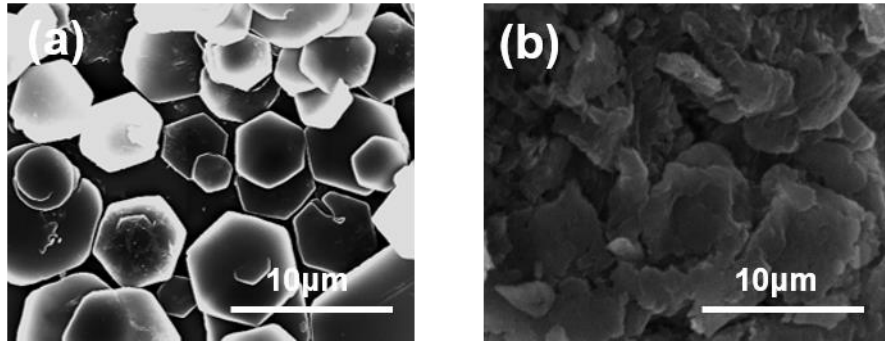
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Fig. S1. Low magnification SEM images of LDH (a) and SPANi/LDH (b).

Fig. S1 can be applied to analyze the integrity of LDHs and SPANi/LDH. Due to the destruction of acidic condition and the connection of a bit sulfonated polyaniline, SPANi/LDH is easier to reunite on its edge.
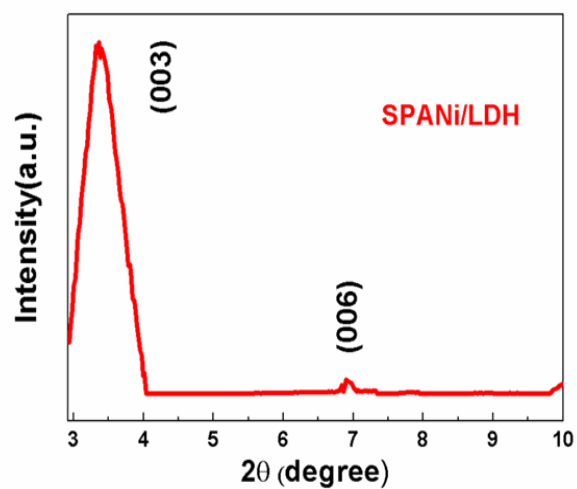
Fig. S2. Low angle XRD patterns of SPANi/LDH.

Compared with the XRD pattern of LDH in Fig.2a, a (003) diffraction peak appear at about $2\theta=3.39°$, and the interlayer spacing is up to 2.67 nm. It is possible to determine that the interlayer space is extended by the guest polymer of SPANi.
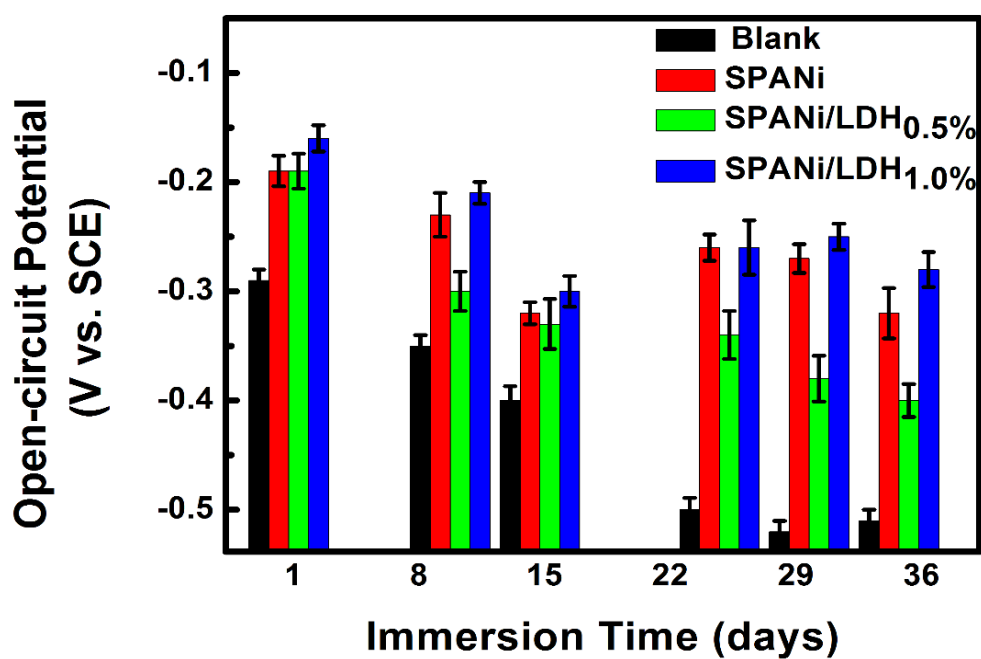
Fig. S3. Evolution of OCP value for the specimens in different immersion time (day 1, 10, 15, 25, 30, 35).

The OCP value of all samples declined initially because of the corrosion in the pinholes. However, the coating with pigment declined slowly due to the barrier effect of LDH.
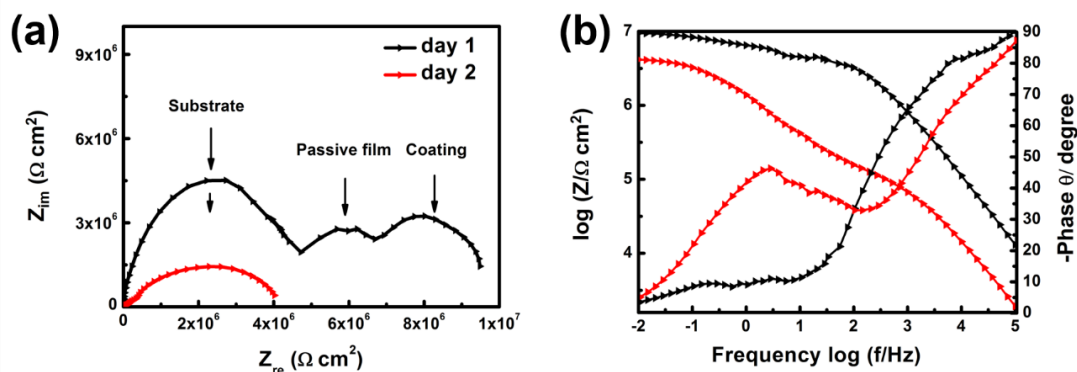
Fig. S4 Nyquist (a) and Bode (b) plots of the specimen with SPANi/LDH$_{1.5\%}$ after two days' immersion.

In Fig. S4a, three obvious time constants appear in this system, which means that the corrosive medium has already destroyed the coating within 24 hours. Sulfonated polyaniline has been reduced and formed a new barrier (the second time constant). At the second day's immersion, the barrier effect of the coating disappears completely and the corrosive medium corrodes the metal substrate. Furthermore, the impedance modulus is lower than 10^7 Ω cm^2, which cannot be applied in practice. The next day, coating and passivation film completely are out of effect, the metal matrix began to corrode from Fig. S4b. The impedance modulus will drop sharply thereafter.
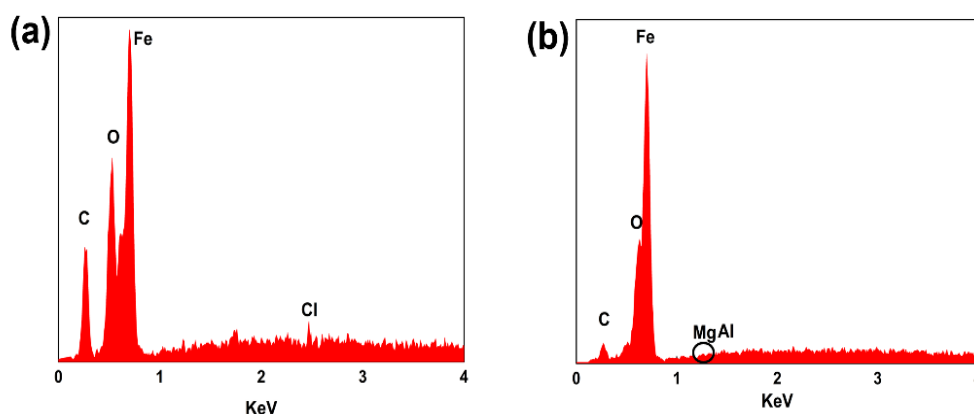
Fig. S5. EDS spectra of the corrosion products beneath the mild steel substrates coated with (a) epoxy coating and (b) (SPANi/LDH)/epoxy coatings.

The enriched chloride (Cl^-) united with the Fe_2O_3 to form the $Fe_2(OH)_3Cl$, so the element Cl exist in the EDS of corrosion products coated with pure epoxy. Besides, in the carbon steel, a serious corrosion has taken place. However, the SPANi/LDH composite coating exhibit the significant anticorrosive ability, due to its lower oxygen content (compared with iron element) in Fig. S5b. The element of Mg and Al from hydrotalcite contained in the coating also appears in this figure. Moreover, the difference of relative content of carbon in Fig. S5a and b is due to the uneven distribution of carbon element in the mild steel.