Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Material for

Corrosion properties of steel in 1-butyl-3-methylimidazolium hydrogen sulfate ionic liquid systems for desulfurization application

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1. Linear fitting of weight loss as a function of time

The kinetics of the corrosion reaction shows a linear dependence on time could be expressed by the equation:

$$\Delta W = kt \tag{1}$$

where ΔW is the weight loss per unit area of the specimen surface (mg/cm^2), t is the exposure time (day) and k is the weight loss rate constants. The k of SS316L immersed in four IL systems for 33 days are determined by regression using the linear equations. The fitting results are illustrated in Table S1.

Table S1. Weight loss rate constants *k* of SS316L in different IL solutions and correlation coefficients R^2 regression analyses of corrosion kinetics.

Results	IL	IL+MO	IL+MO+H_2O	IL+MO+H_2O_2
k	0.122	0.057	0.312	0.787
R^2	0.983	0.976	0.999	0.990

2. IR spectra of stainless steel surface

ATR-FTIR spectra of pristine [BMIM]HSO_4 IL as well as stainless steel after immersion in different IL solutions are shown in Fig. S1. The spectra of surface film of stainless steel in different IL solutions are highly resembled to those of mild steel in corresponding systems. Therefore, it can be concluded that the adsorption of IL molecules on stainless steel surface is same as that on mild steel surface.

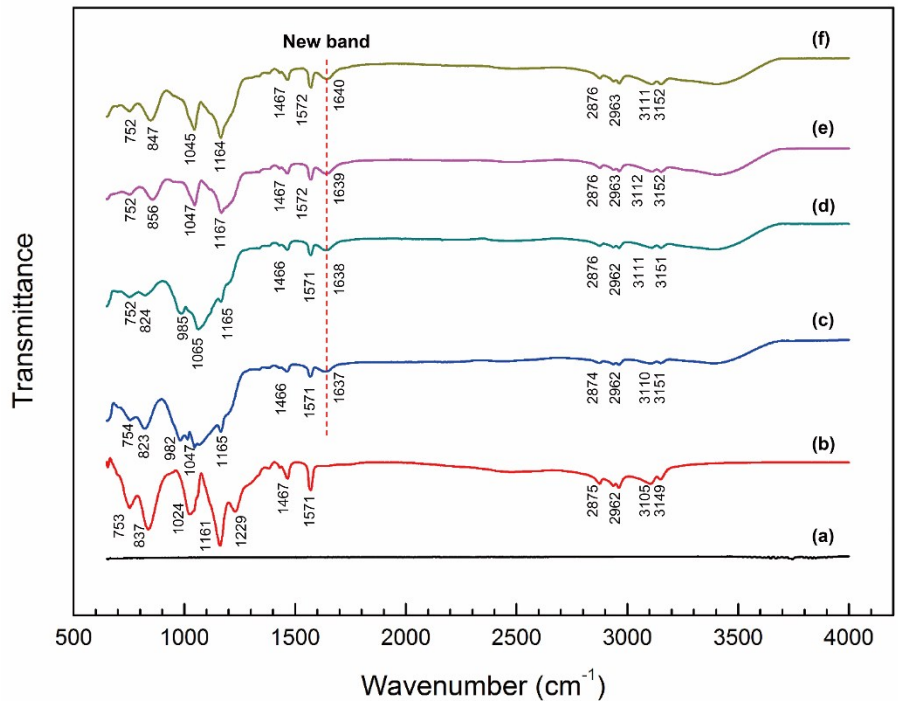

Fig. S1. IR spectra in a range of 650-4000 cm^{-1} of (a) stainless steel, (b) pristine[BMIM]HSO_4 and surface films of stainless steel specimens after immersion in (c) IL, (d) IL+MO, (e) IL+MO+H_2O and (f) IL+MO+H_2O_2 at 45°C for 14 days.

3. Raman spectra of mild steel and stainless steel surfaces before and after cleaning

After the specimens were cleaned, their surfaces were also analyzed by Raman spectrometer. The Raman spectra of mild steel and stainless steel surfaces corroded in IL+MO+H_2O_2 systems before and after cleaning are shown in Fig. S2. The bands observed over the cleaned steel surfaces are extremely weak and invisible. It can be considered almost all the corrosion products are removed from the specimen surfaces after the cleaning procedures.

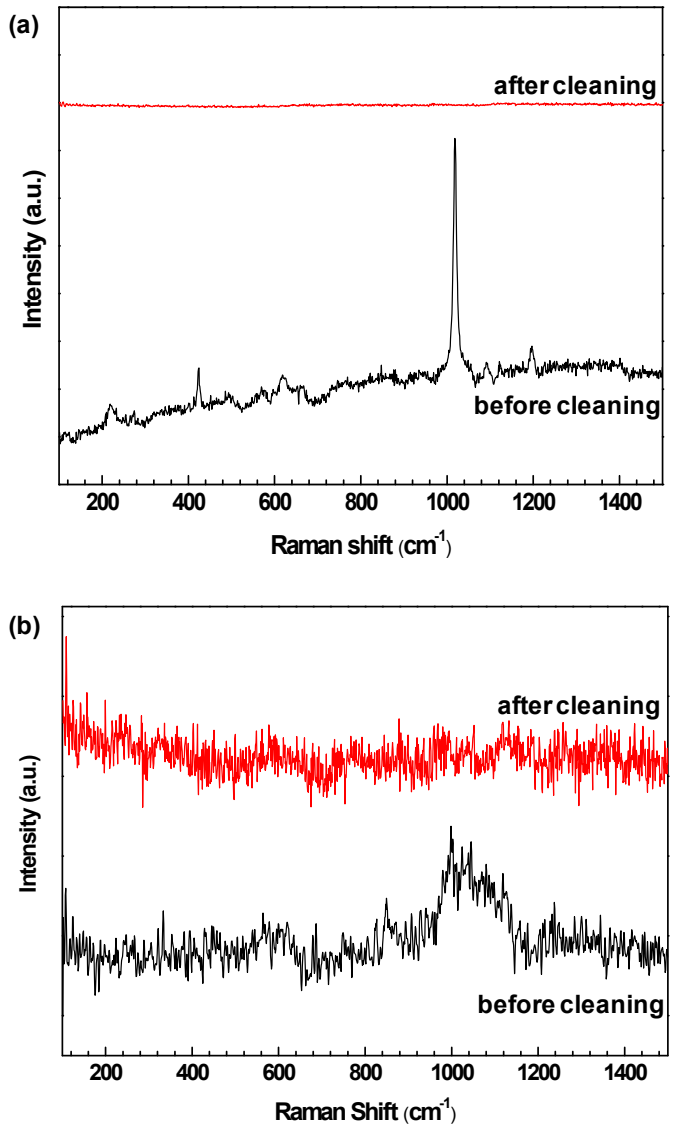

Fig. S2. Raman spectra in a range of 100-1500 cm^{-1} of (a) mild steel and (b) stainless steel surfaces after exposure to IL+MO+H_2O_2 at 45°C for 14 days.

4. SEM of steel surface morphologies before corrosion

Fig. S3 shows the SEM of mild steel surface and stainless steel surface after abrading treatment. Freshly abraded surfaces of steel specimens without corrosion are smooth, and slight scratches made by abrading treatment can be clearly seen.

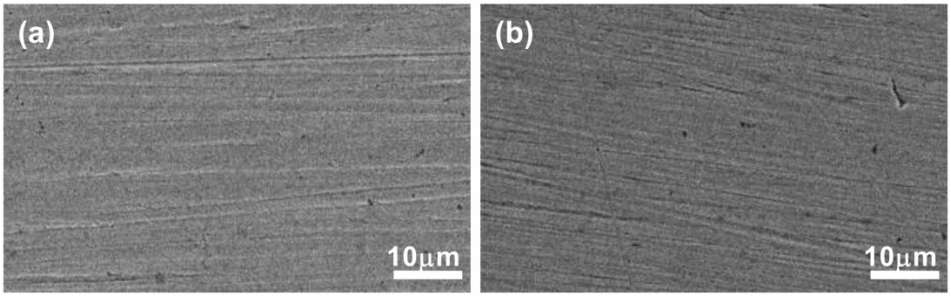

Fig. S3. SEM of the freshly abraded surfaces of (a) mild steel and (b) stainless steel.