Electronic Supplementary Information (ESI)

Microscopic study of the corrosion behaviour of mild steel in ionic liquids for CO_2 capture applications

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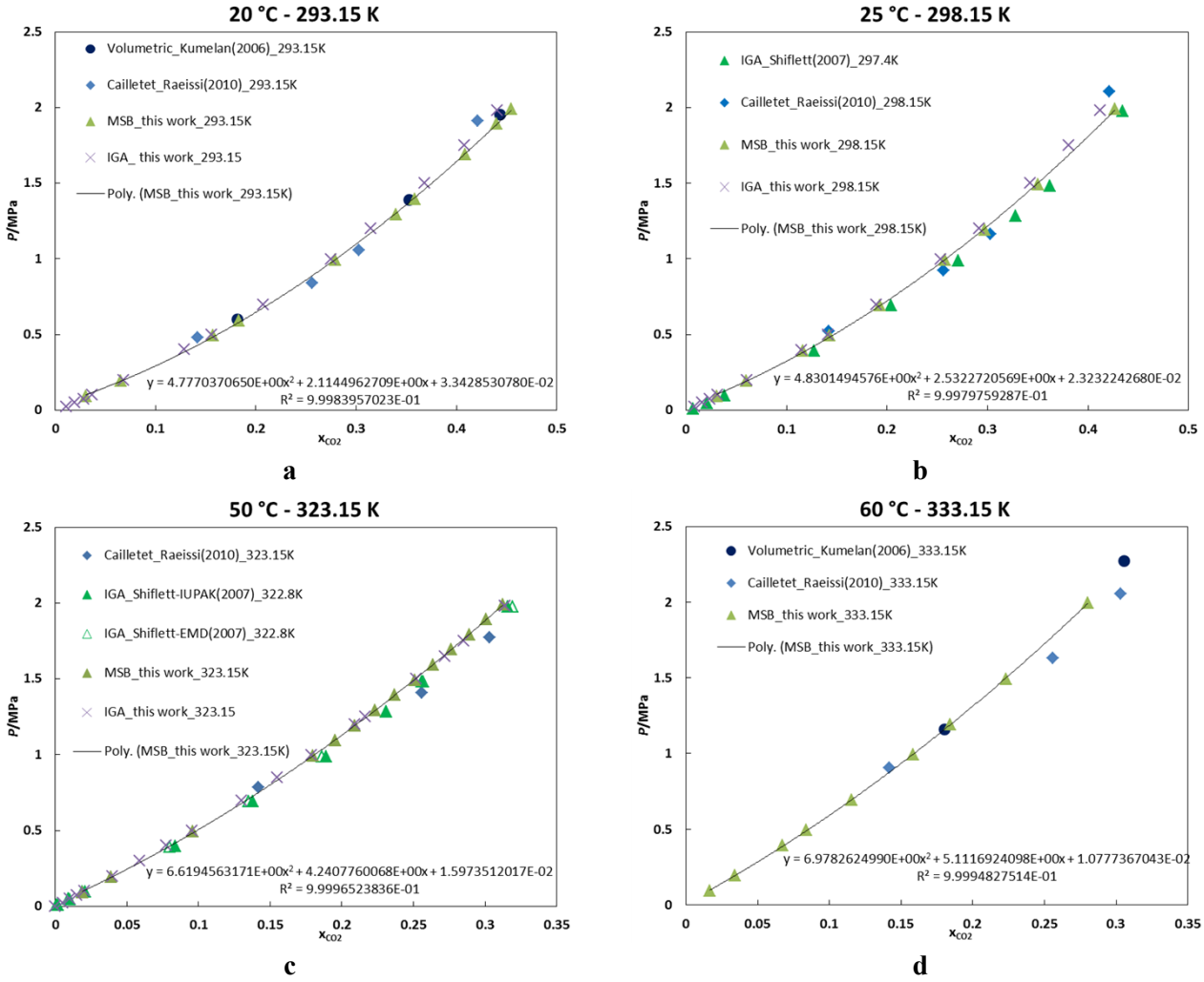

Fig. S1 Absorption isotherms of CO_2 in the ionic liquid 1-hexyl-3-methylimidazolium bis[(trifluoromethyl)sulfonyl]imide at several temperatures. The results obtained with the IGA and MSB microbalances deviate by less than 3 %. The results obtained by other research groups for the same CO_2/IL system are also shown in graphs.[1,2,3] The excellent agreement shows the accuracy of our measurements.

1 S. Raeissi, L. Florusse, and C. J. Peters, Scott–van Konynenburg, *J. Supercrit. Fluids*, 2010, **55**, 825.
2 J. Kumełan, Á. Pérez-Salado Kamps, D. Tuma and G. Maurer, *J. Chem. Thermodyn.*, 2006, **38**, 1396.
3 M. B. Shiflett and A. Yokozeki, *J. Phys. Chem. B*, 2007, **111**, 2070.

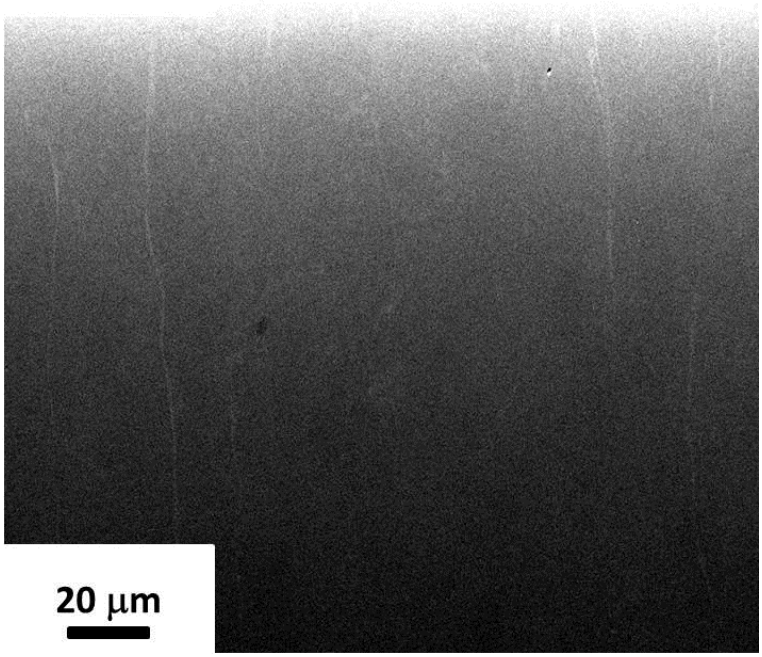

Fig. S2 2D X-ray image of the MS plate after immersion in [C_4mim]TCM at 80 °C for 3 days. The rolling direction is parallel to the vertical axis of the image.

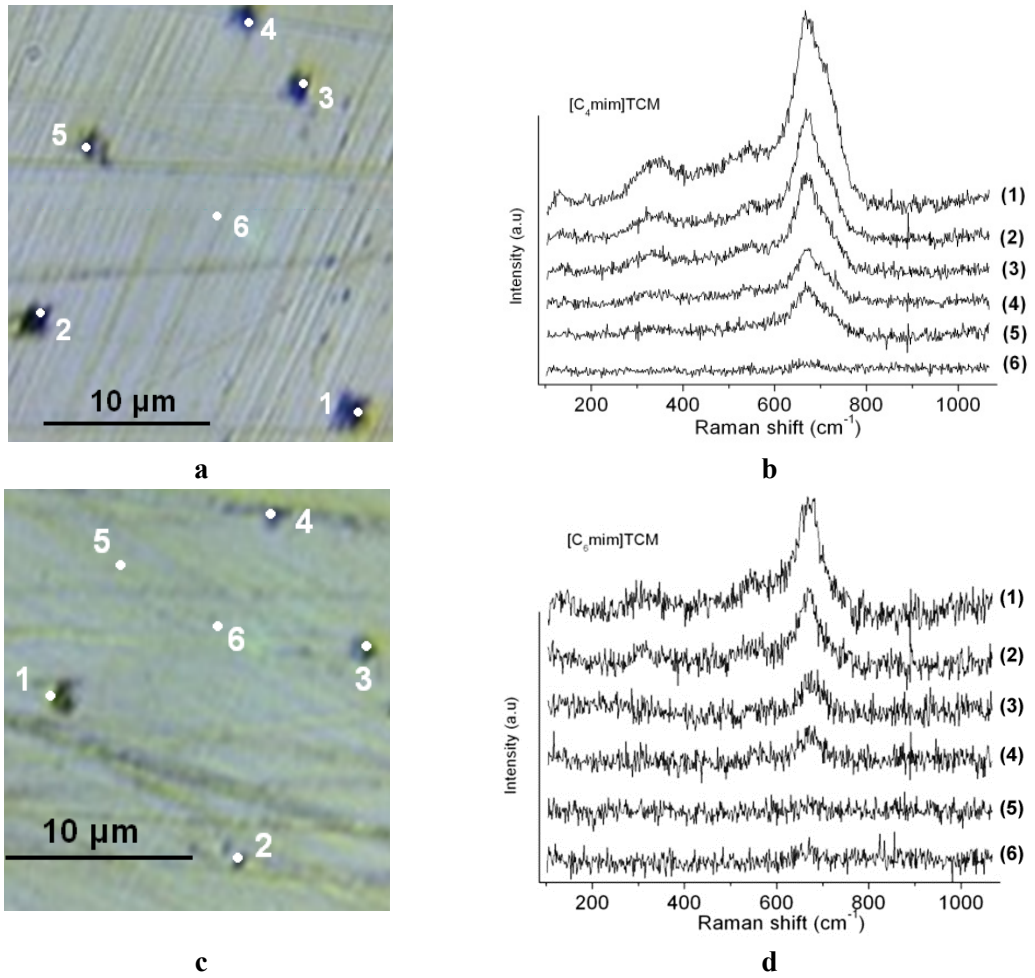

Fig. S3 Optical micrographs and the respective micro-Raman spectra acquired from the selected spots on the surface of mild steel immersed in (a, b) [C_4mim]TCM and (c, d) [C_6mim]TCM(s) at 80 °C for 30 days.

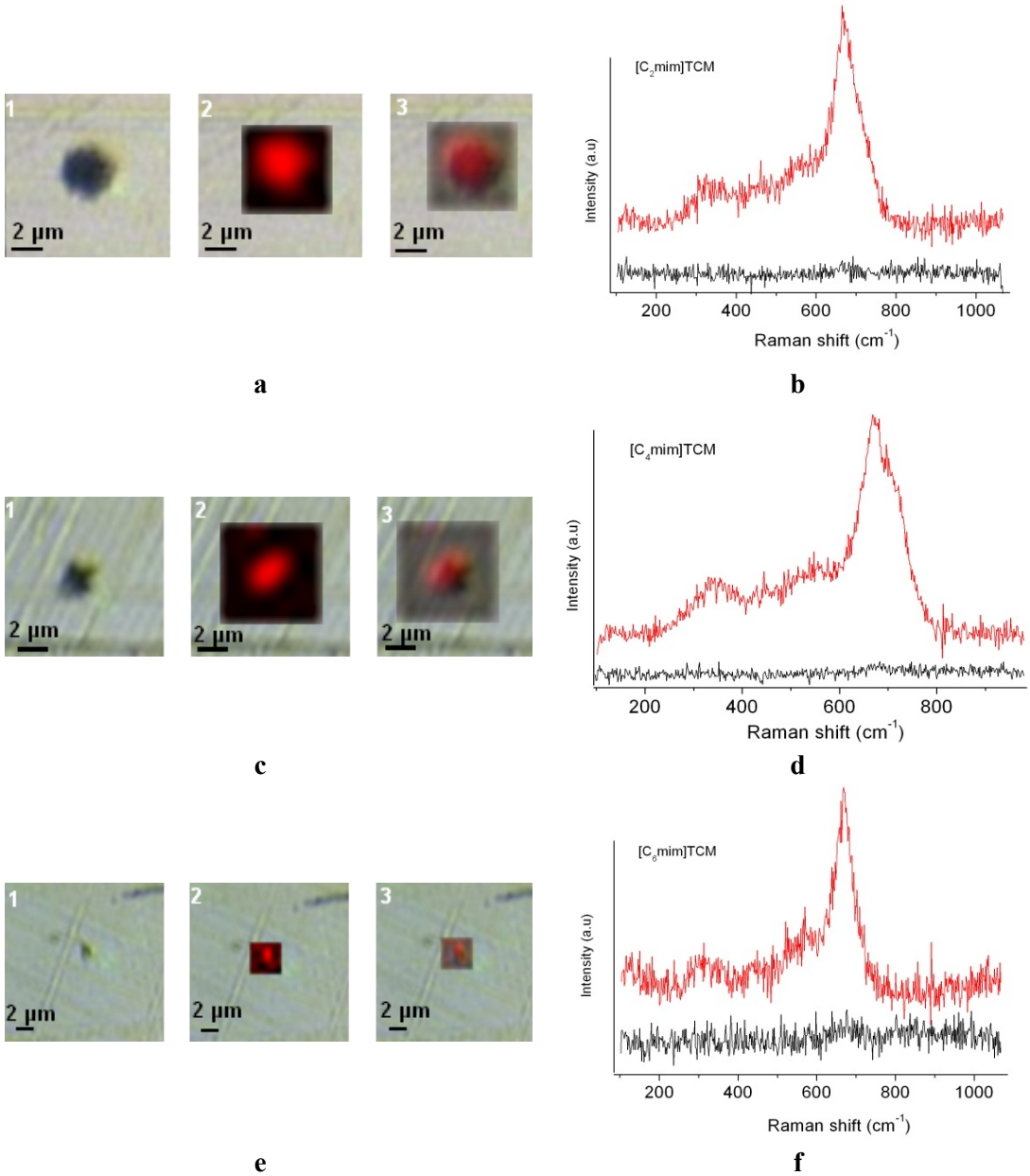

Fig. S4 (a) [1] Optical image of a crater on the surface of mild steel immersed in [C_2mim]TCM; [2] 670 cm^{-1} Raman signal to baseline ratio mapping of the selected crater and its surrounded area in the chromatic scale; [3] the blend of the images [1] and [2]; (b) representative Raman spectra from the mapping; the red spectrum corresponds to a spot from the centre of the crater with intense Raman signal, while the black spectrum corresponds to a spot outside of its borders with weak signal. Corresponding images and spectra for mild steel immersed in [C_4mim]TCM and [C_6mim]TCM(s) are shown in (c, d) and (e, f) respectively. Immersion was carried out at temperature of 80 °C for 30 days.

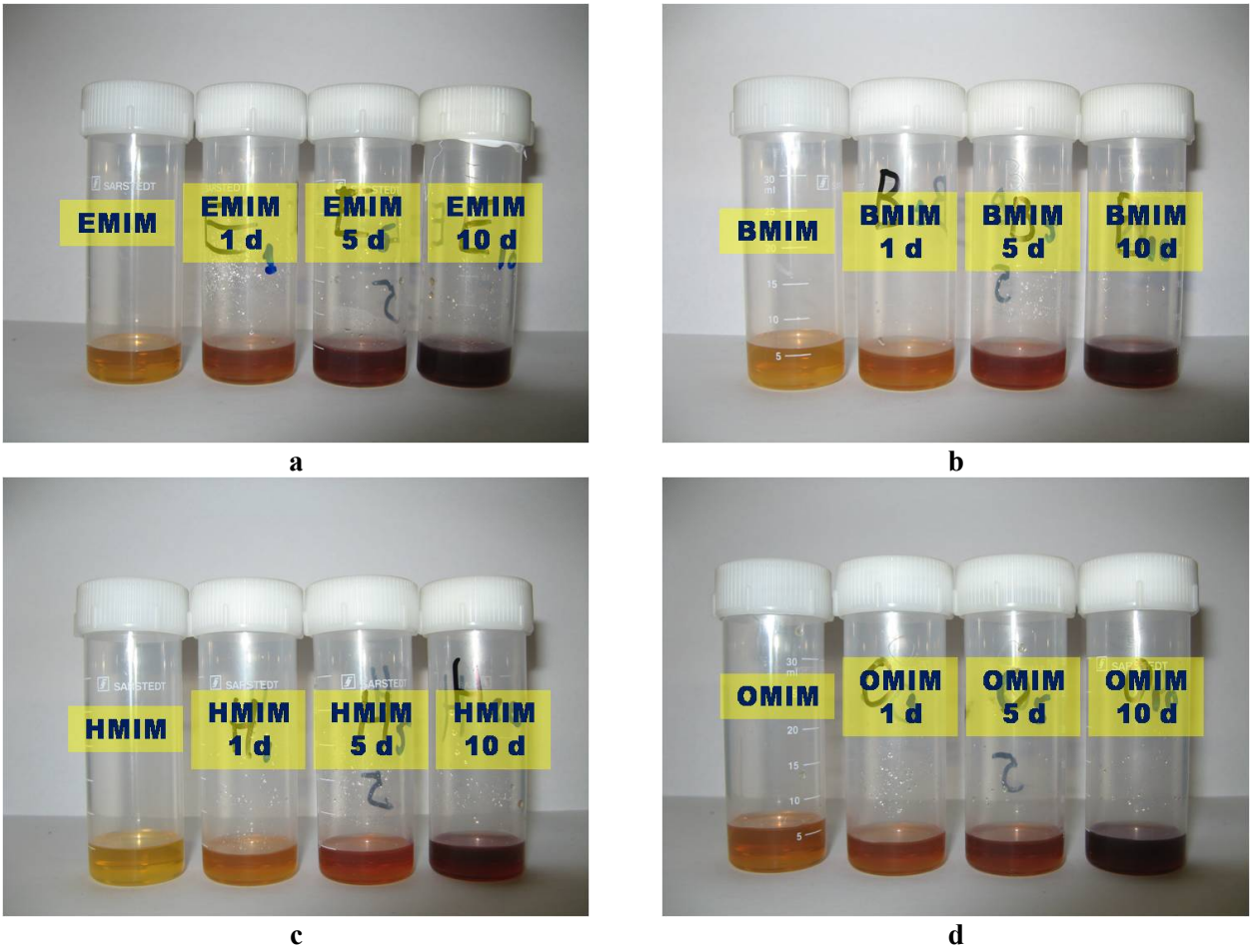

Fig. S5 Photographic images of the appearance of (a) [C_2mim]TCM, (b) [C_4mim]TCM (c) [C_6mim]TCM(s) and (d) [C_8mim]TCM, designated as EMIM, BMIM, HMIM and OMIM respectively, after keeping with immersed mild steel at 80 °C for 1, 5 and 10 days. The samples on the left of each image are as-received ionic liquids.

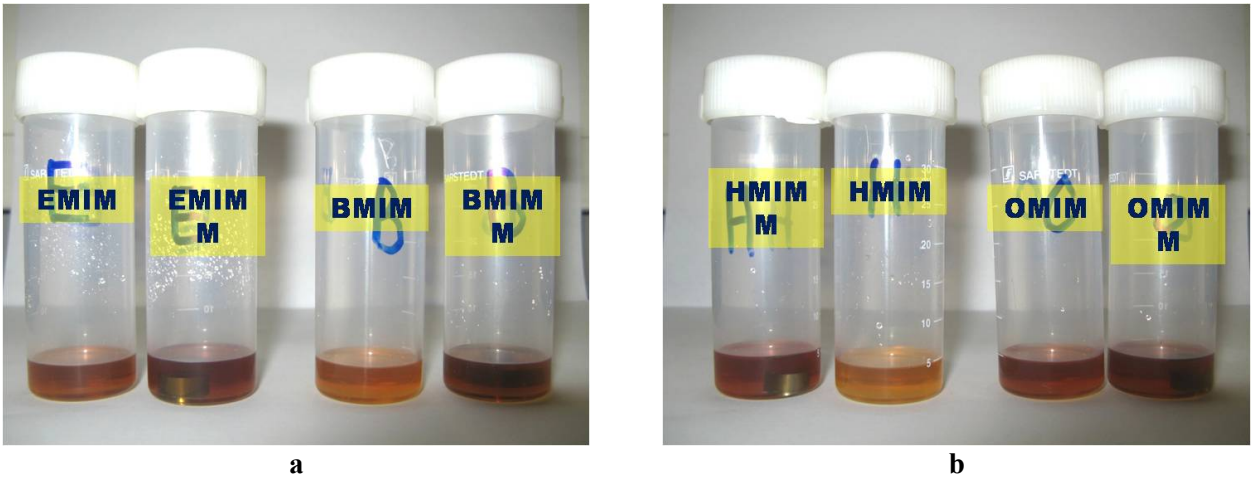

Fig. S6 Photographic images comparing appearance of (a) [C_2mim]TCM and [C_4mim]TCM and (b) [C_6mim]TCM(s) and [C_8mim]TCM after keeping at 80 °C for 3 days with immersed mild steel (designated by "M") and without immersed alloy.