Supporting Information for

Cross-sectoral synergy between municipal wastewater treatment, cement manufacture and petrochemical synthesis via clean transformation of sewage sludge

Sicong Tian[1,3]*,[#] Jingjing Chen[2,#] Feng Yan[1], Candace Lang[4], Vladimir Strezov[5], Zuotai Zhang[1]*

[1]School of Environmental Science and Engineering, Southern University of Science and Technology, Shenzhen 518055, P. R. China

[2]School of Environmental, Harbin Institute of Technology, Harbin 150091, P. R. China

[3]Dow Centre for Sustainable Engineering Innovation, School of Chemical Engineering, the University of Queensland, Brisbane, Queensland 4072, Australia

[4]School of Engineering, Macquarie University, Sydney, New South Wales 2109, Australia

[5]Department of Earth and Environmental Sciences, Macquarie University, Sydney, New South Wales 2109, Australia

*Corresponding authors. Email: sicong.tian@outlook.com; zhangzt@sustc.edu.cn

[#]These authors contributed equally to this work.

Table S1. Chemical composition of the sewage sludge sample on dry basis.

Proximate analysis [a]	**Content (wt.%)**	**Ash component**	**Content (wt.%)** [c]
Volatile matter	40.08	CaO	25.44
Ash	59.92	SiO_2	11.35
Fixed carbon	n.d.	Al_2O_3	9.23
Ultimate analysis [b]	**Content (wt.%)**	Fe_2O_3	6.17
C	14.91	P_2O_5	3.13
H	3.53	SO_3	1.61
N	2.27	MgO	1.23
S	0.59	Cl	0.79
		Others	0.97

[a], The proximate analysis was performed by using a thermogravimetric analyzer (TGA, TGA/DSC 1, Mettler Toledo); [b], The ultimate analysis was performed by using an elemental analyzer (Vario EL III, Elementar); [c], The content of ash components was determined by means of X-ray fluorescence (XRF).

Table S2. Elemental composition of the raw sludge ash and commercial cement as determined by X-ray fluorescence (XRF).

Element	Content (%)	
	Raw sludge ash	Commercial cement
Ca	30.35	51.99
Si	8.85	6.58
Al	8.15	1.87
Fe	7.19	2.82
P	2.28	0.0481
S	1.07	1.05
Mg	1.24	0.779
Cl	1.32	0.007
K	0.421	0.551
Ti	0.213	0.282
Ni	0.155	0.0054
Na	0.14	0.114
Zn	0.118	0.0204
Mn	0.0417	0.104
Cr	0.021	0.0058
Ba	0.0265	Not detected
Cu	0.0168	0.0059
Sn	0.0124	Not detected
Hg	0.0113	Not detected
Co	0.0063	0.0042
Pb	Not detected	0.014
Sr	0.0161	0.0308
Ag	Not detected	0.0242
V	Not detected	0.0104

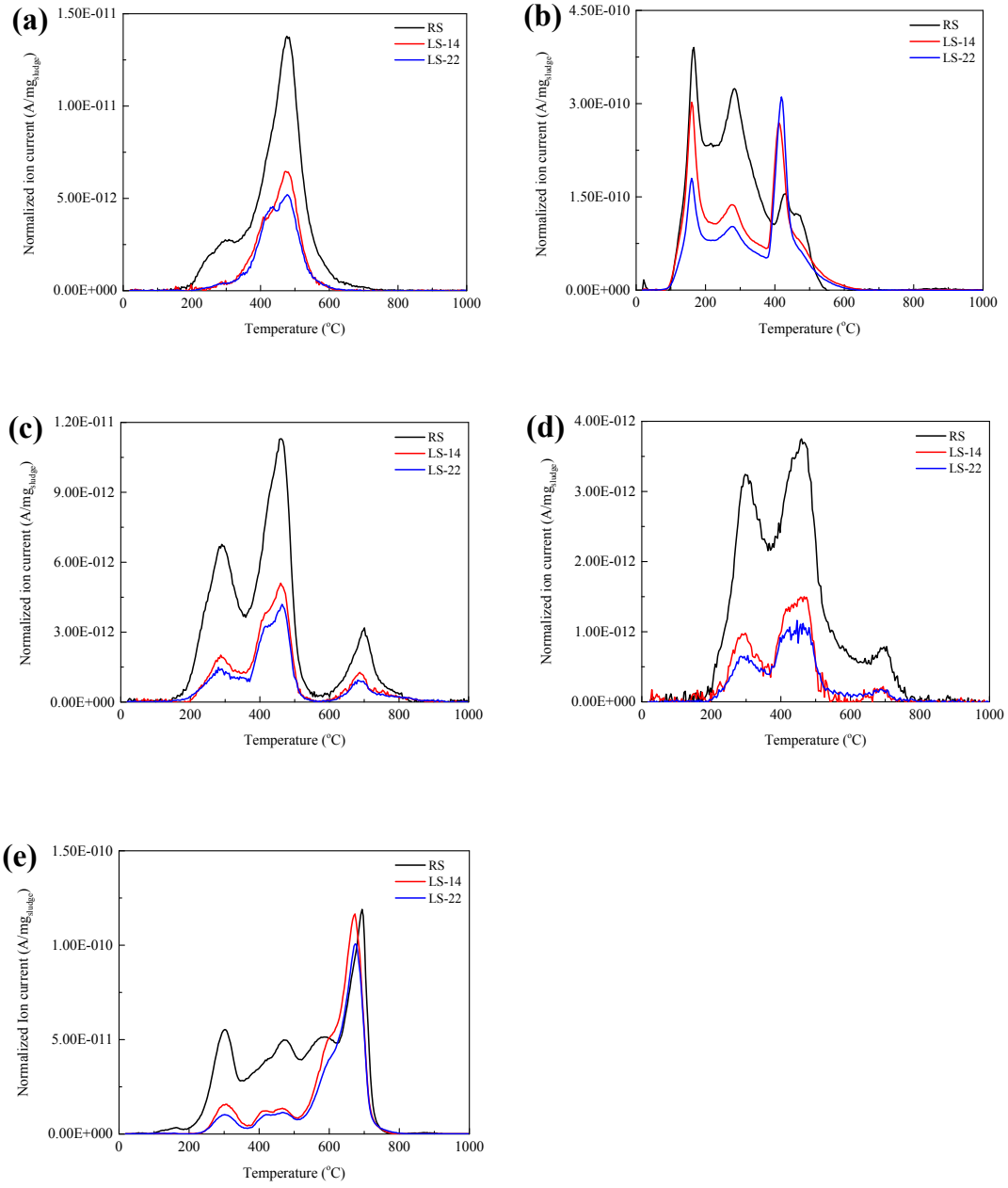

Figure S1. Emission intensity of (a) CH_4 (m/z = 15), (b) H_2O (m/z = 18), (c) C_3H_8 (m/z = 29), (d) NO_x (m/z = 30), and (e) CO_2 (m/z = 44), as a function of temperature, during the temperature-programmed pyrolysis of sewage sludge.

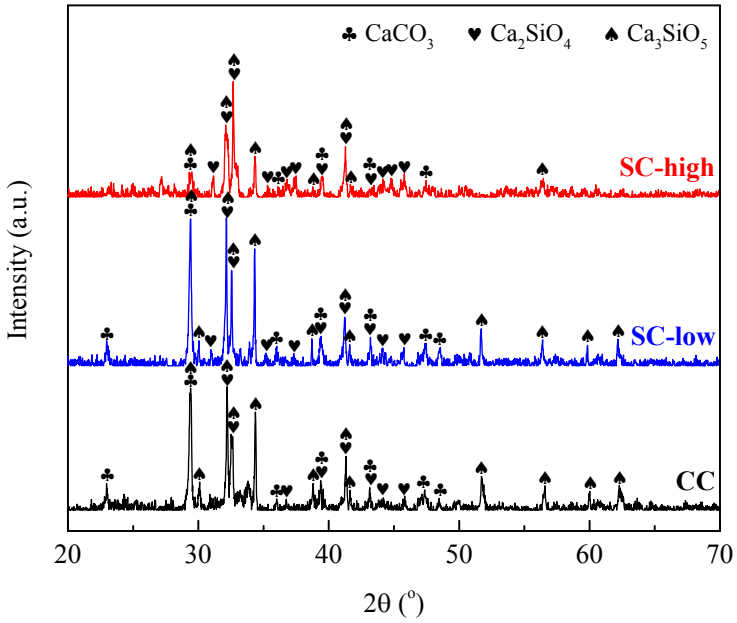

Figure S2. X-ray diffraction (XRD) patterns of the commercial cement (CC) and the cement prepared from pyrolysis residues of the lime-blended sewage sludge.

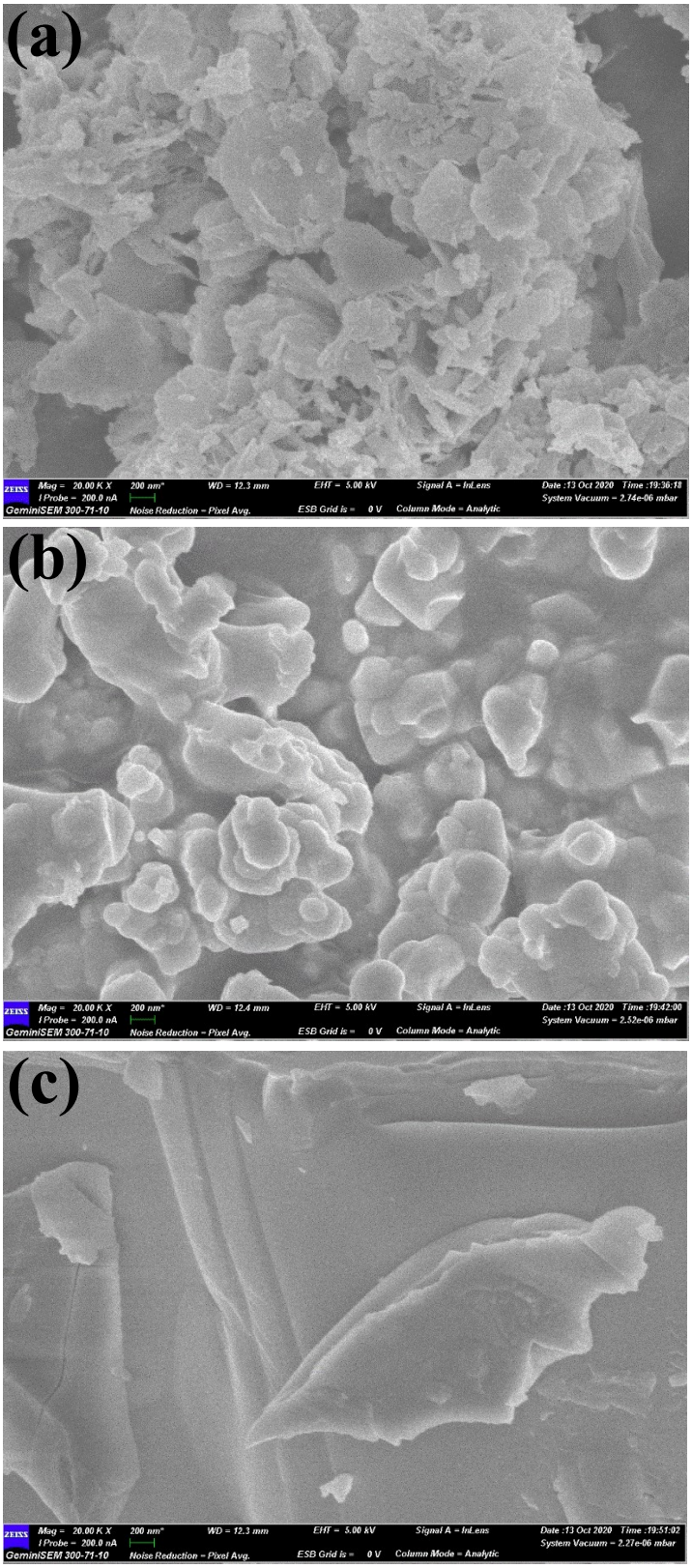

Figure S3. Scanning electron microscope (SEM) images of the LS-22 residue after a calcination at (a) 700 °C, (b) 1100 °C and (c) 1300 °C, respectively.