Supporting Information

Effects of a Catalyst on the Nanostructure and Reactivity of Soot under an Oxygen Atmosphere

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Image processing of TEM images

TEM image processing was implemented using MathWorks MATLAB software, the program algorithm is shown in Figure. S1. And the processing status of CB, partially oxidized soot A and soot B are shown in Figure. S2, Figure. S3, Figure. S4, Figure. S5 and Figure. S6.

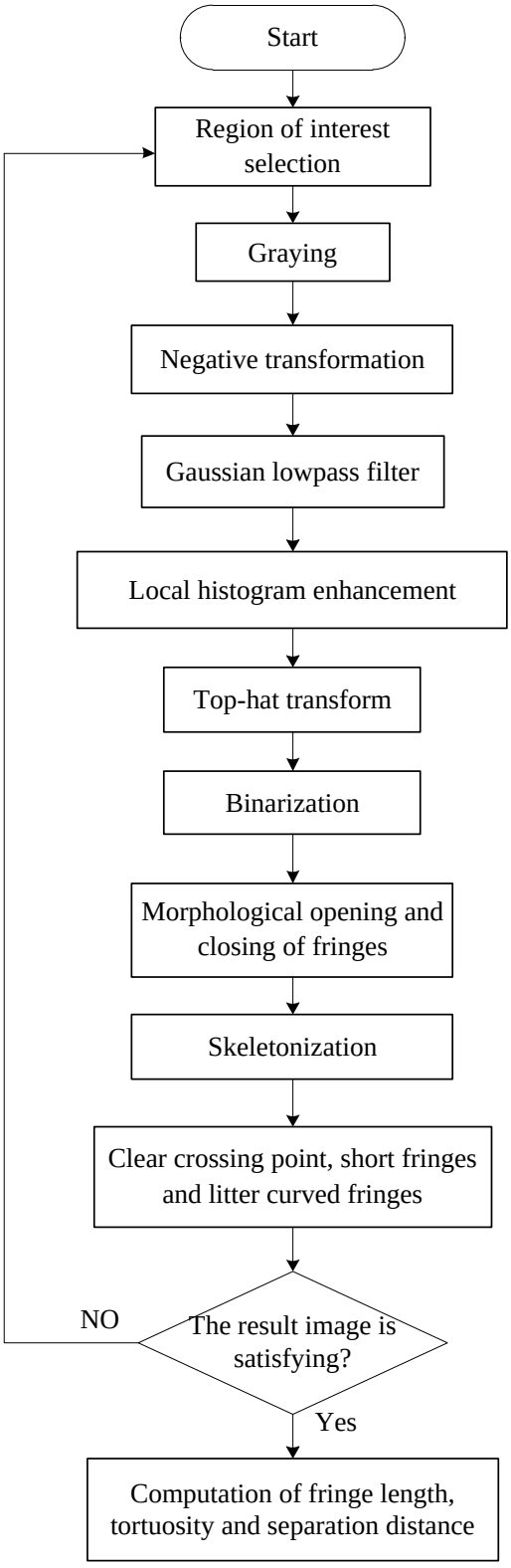


Figure. S1 Flow chart of TEM image processing

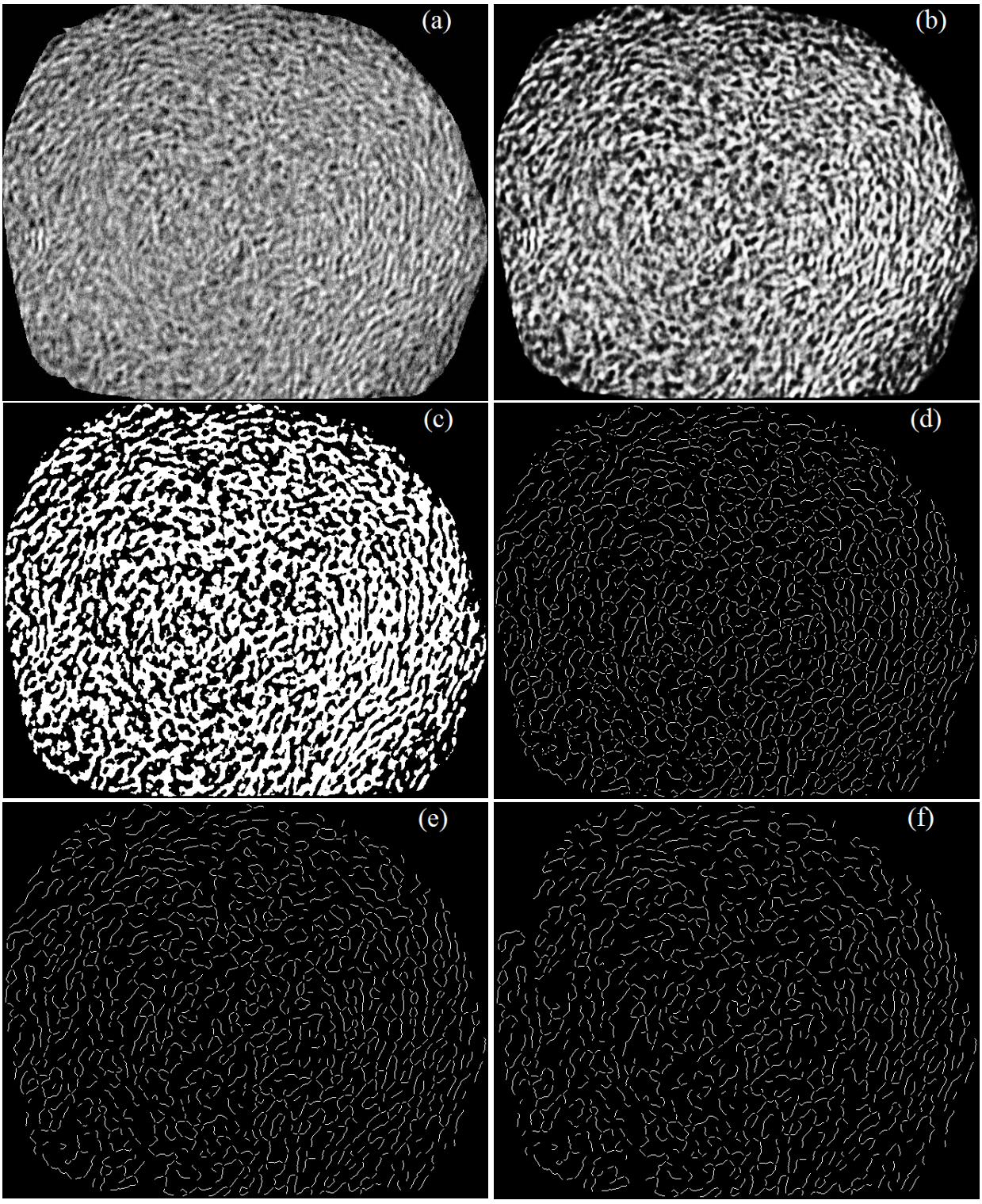


Figure. S2 Image processing status of CB: (a) result after graying; (b) result after negative transformation; (c) result after binarization; (d) result after clear crossing points; (e) result of clear short fringes; (f) result of clear litter curved fringes.

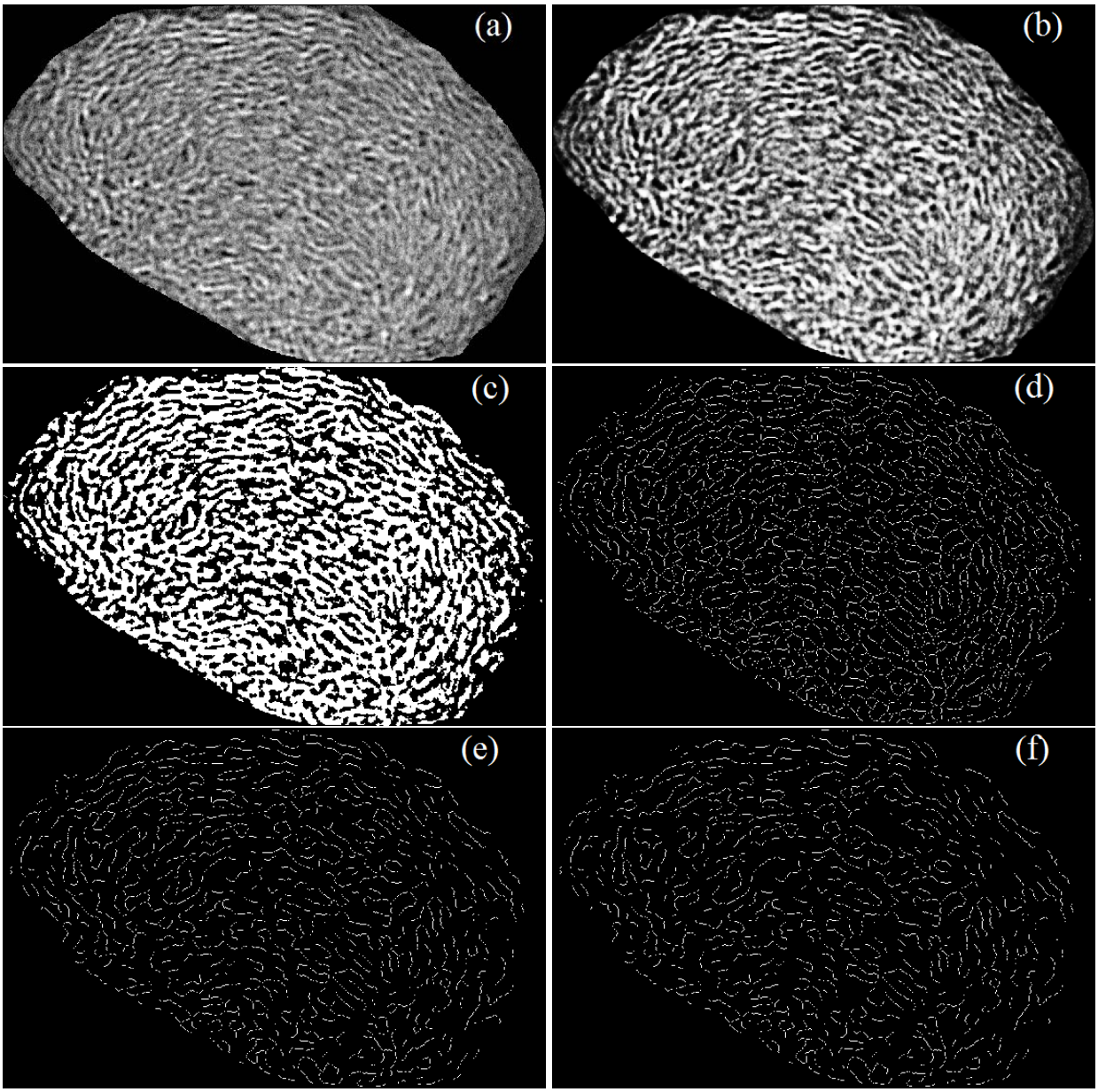
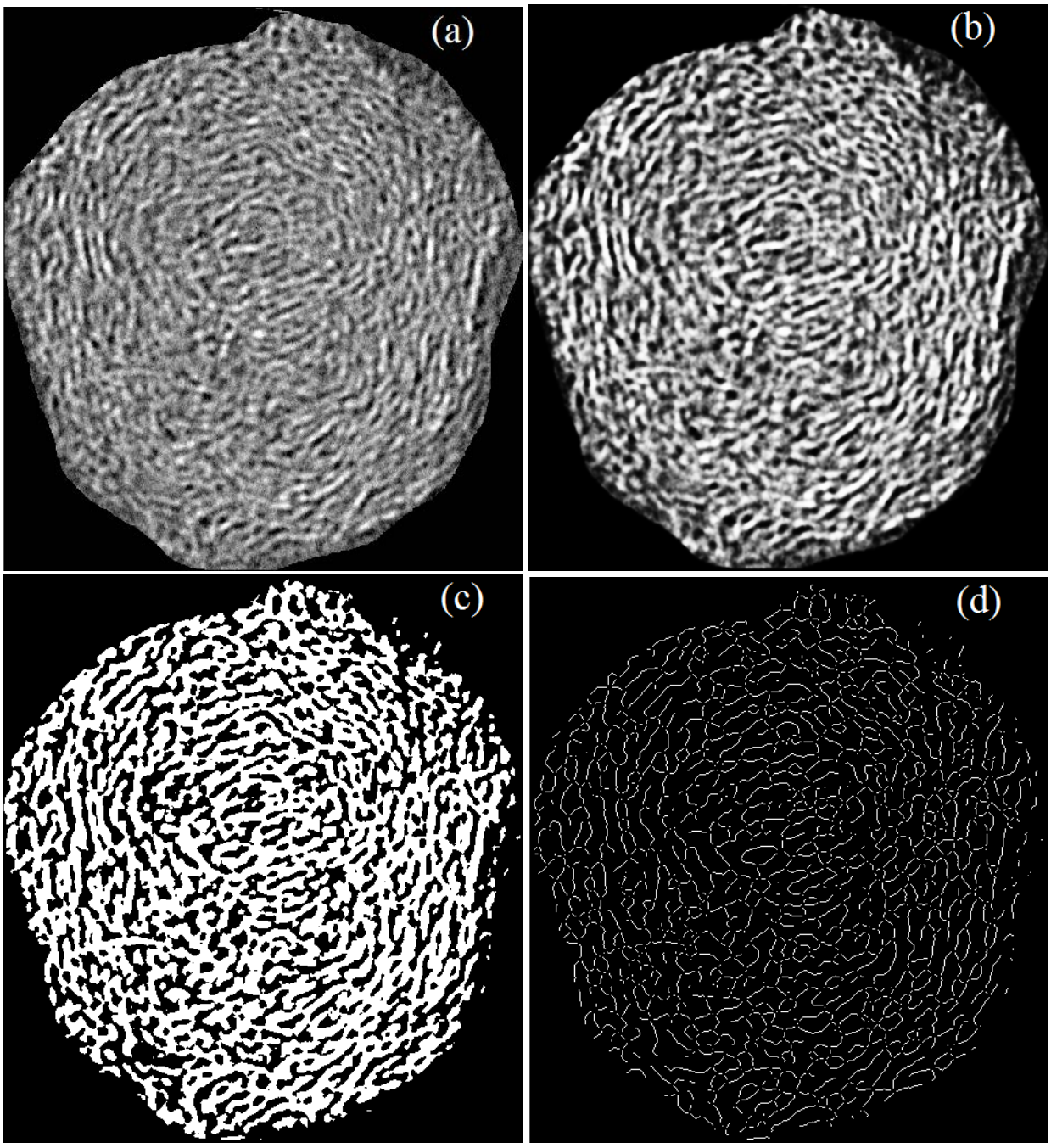


Figure. S3 Image processing status of soot A at ending temperature of 650℃: (a) result after graying; (b) result after negative transformation; (c) result after binarization; (d) result after clear crossing points; (e) result of clear short fringes; (f) result of clear litter curved fringes.


(a)
(b)
(c)
(d)

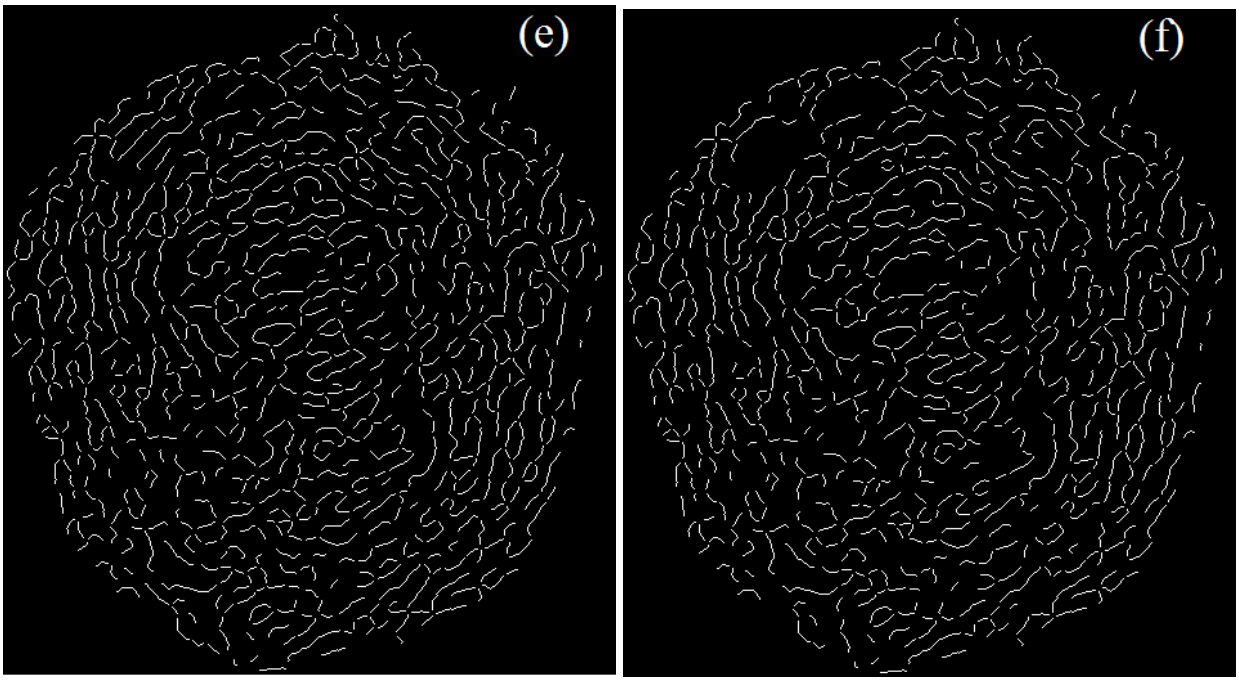
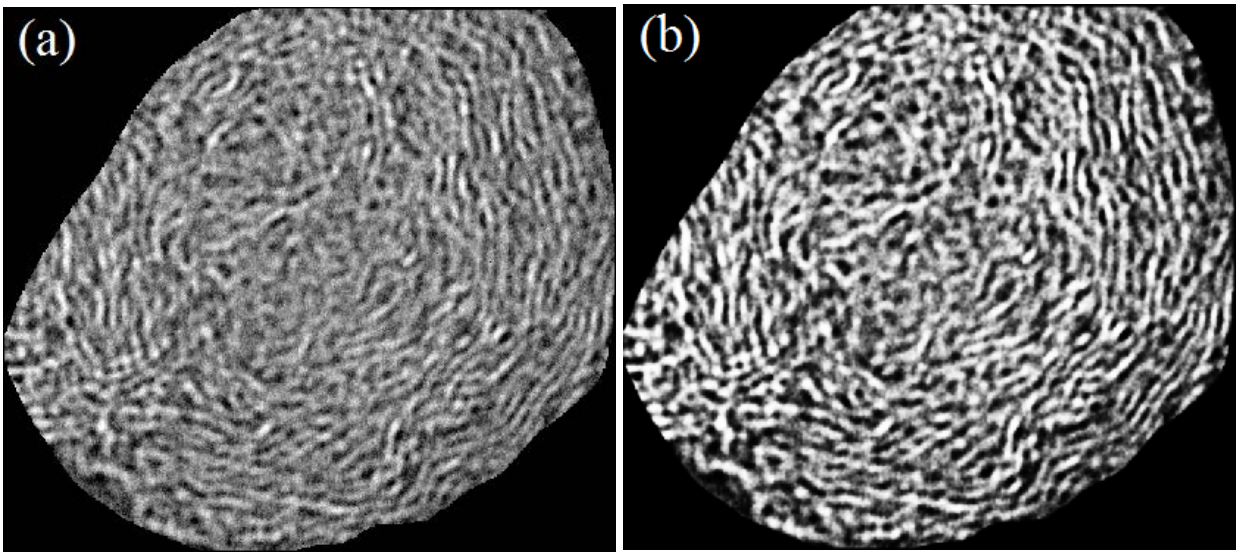


Figure. S4 Image processing status of soot B at ending temperature of 650℃: (a) result after graying; (b) result after negative transformation; (c) result after binarization; (d) result after clear crossing points; (e) result of clear short fringes; (f) result of clear litter curved fringes.



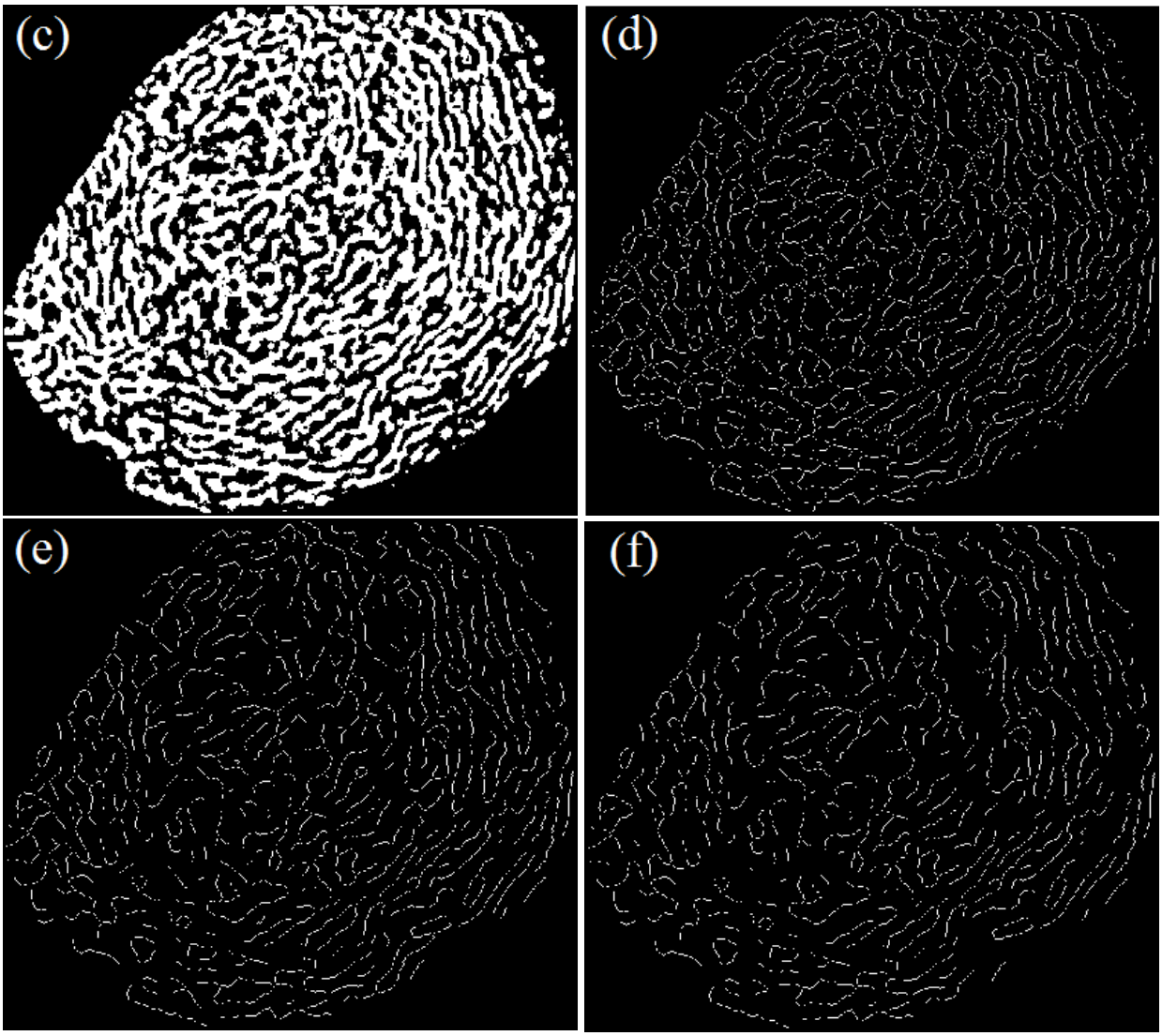


Figure. S5 Image processing status of soot A at ending temperature of 1000℃: (a) result after graying; (b) result after negative transformation; (c) result after binarization; (d) result after clear crossing points; (e) result of clear short fringes; (f) result of clear litter curved fringes.

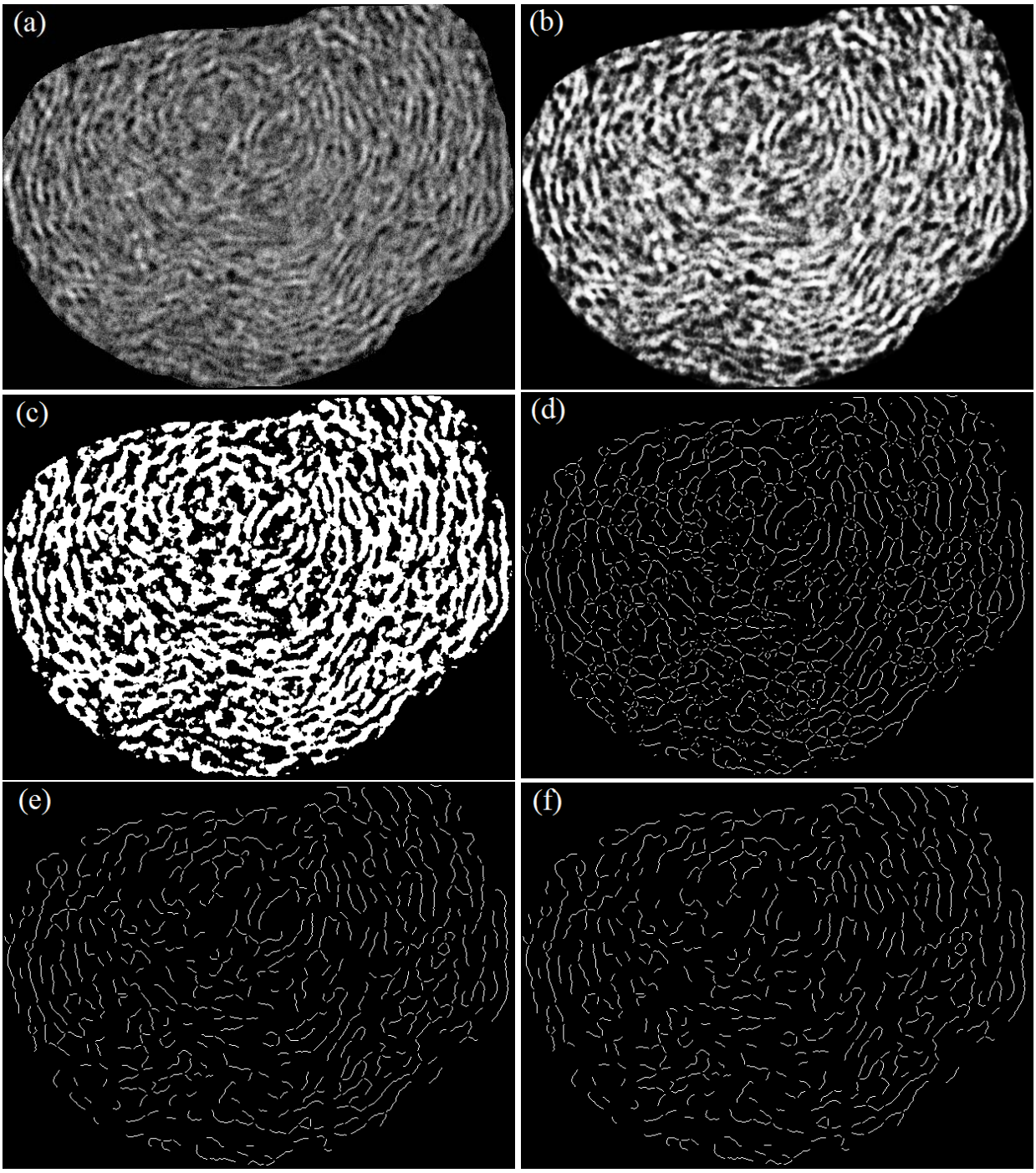
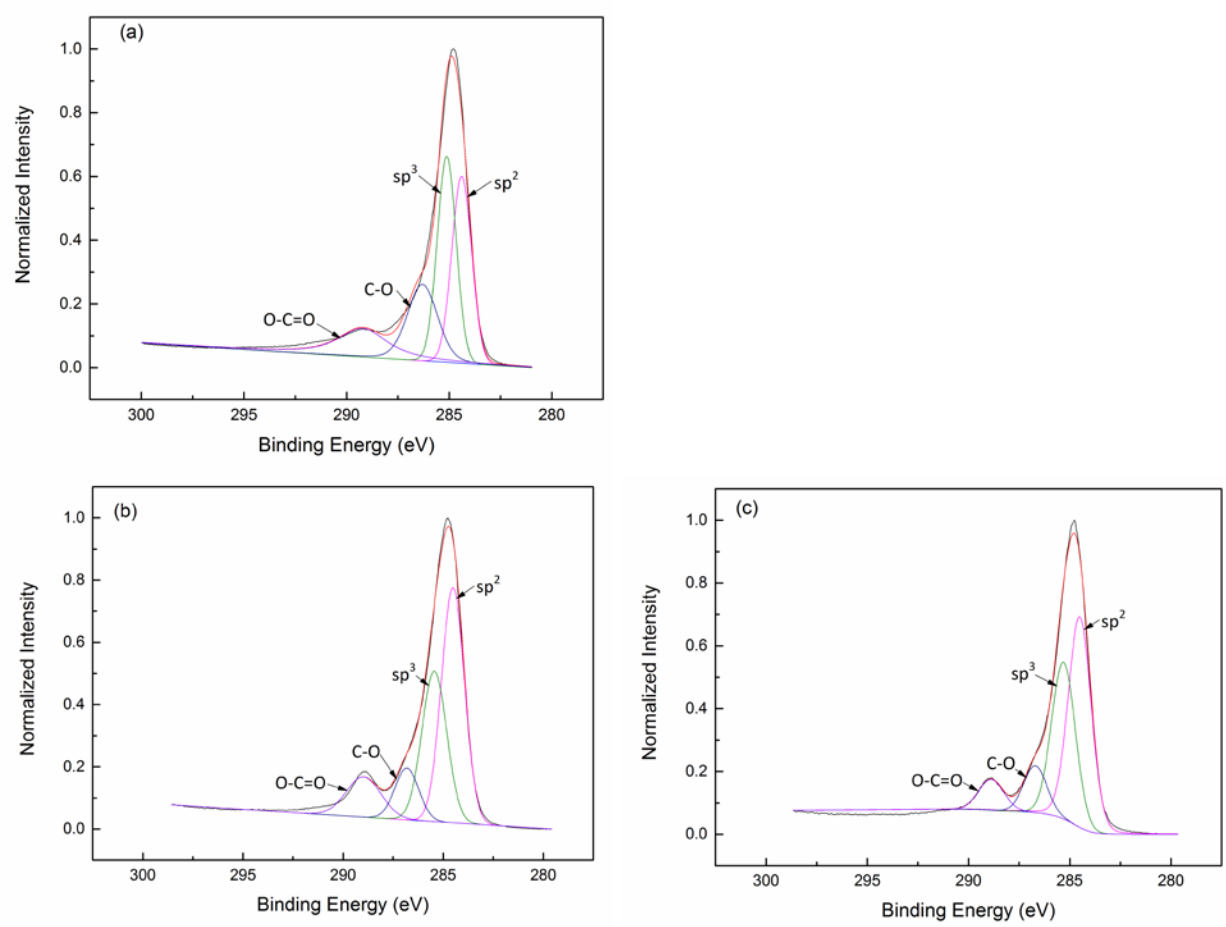


Figure. S6 Image processing status of soot B at ending temperature of 1000℃: (a) result after graying; (b) result after negative transformation; (c) result after binarization; (d) result after clear crossing points; (e) result of clear short fringes; (f) result of clear litter curved fringes.

Curve fitted of XPS spectra

The XPS spectra was deconvolved into 4 Gaussian curves after normalization, data analysis was performed using XPSPEAK. Figure. S7 shows curve fitted results of CB, partially oxidized soot A and soot B, and Table. S1 gives fitting results summary of C1s XPS spectra of CB, partially oxidized soot A and soot B.



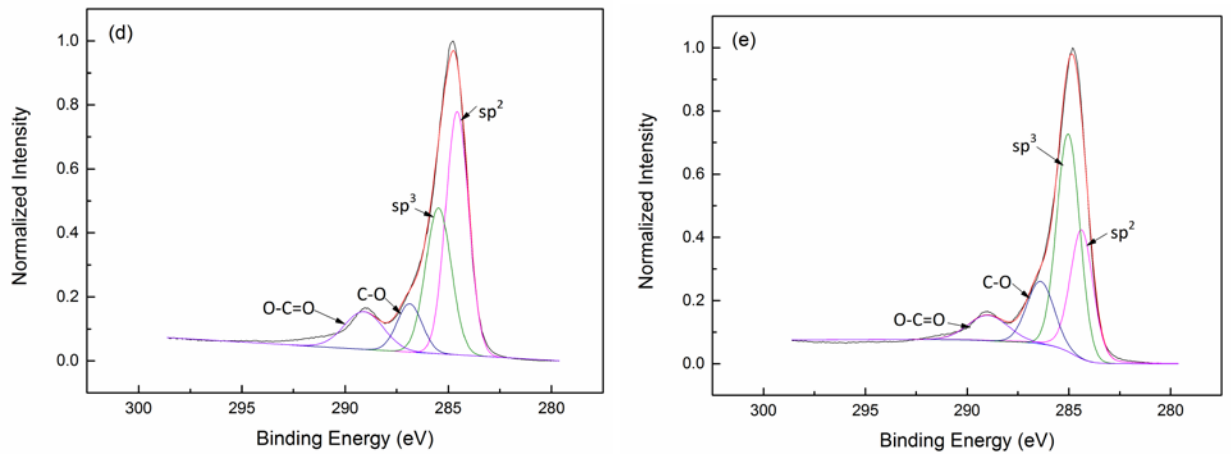


Figure. S7 XPS spectra of (a) CB; (b) soot A and (c) soot B at ending temperature of 650℃; (d) soot A and (e) soot B at ending temperature of 1000℃.

Table. S1 Fitting results summary of C1s XPS spectra

BE(eV)	Functional group	CB	Area			
			soot A at 650℃	soot A at 1000℃	soot B at 650℃	soot B at 1000℃
284.6	sp^2 hybridization	0.709	1.088	1.056	0.987	0.607
285.4	sp^3 hybridization	0.747	0.748	0.707	0.734	0.981
286.4	C-O	0.474	0.247	0.228	0.212	0.33
288.6	O-C=O	0.375	0.281	0.278	0.153	0.199

Curve fitted of Raman spectra

The Raman spectra was curve fitted with 3 Lorentzian bands and 1 Gaussian band, data analysis was performed using ORIGIN 9.0 software. Table. S2 gives fitting results summary of Raman spectra of partially oxidized soot A and soot B.

Table. S2 Fitting results summary of Raman spectra

Raman shift (cm^{-1})	Characteristic band	Area			
		soot A at 650℃	soot B at 650℃	soot A at 1000℃	soot B at 1000℃
1360	D_1	77903.45253	73509.89044	45111.6846	41603.95622
1500	D_3	13327.98297	31550.38325	7792.27899	18642.09908
1580	G	20223.45134	17478.54997	13512.97308	8788.98644