The Effect of Metal Salts on Quantification of Elemental and Organic Carbon in Diesel Exhaust Particles using Thermal-Optical Evolved Gas Analysis

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This supplemental material contains 1 Table and 7 Figures

Table S1: Mole fractions of metal salts and their hydrates[a].

	mole fraction of salt		mole fraction of hydrate
$Fe_2(SO_4)_3$	0.27	$Fe_2(SO_4)_3 \cdot 5H_2O$	0.73
$CuSO_4$	0.53	$CuSO_4 \cdot 5H_2O$	0.47
Na_2SO_4	0.96	$Na_2SO_4 \cdot 10H_2O$	0.04
$MnCl_2$	0.13	$MnCl_2 \cdot 4H_2O$	0.87
$MgCl_2$	0.48	$MgCl_2 \cdot 6H_2O$	0.52
$FeCl_3$	0.84	$FeCl_3 \cdot 6H_2O$	0.16
$FeCl_2$	0.48	$FeCl_2 \cdot 4H_2O$	0.52
$CaCl_2$	0.00	$CaCl_2 \cdot 6H_2O$	1.00
$CuCl_2$	0.21	$CuCl_2 \cdot 2H_2O$	0.79
NaCl	1.00		
KCl	1.00		
CuCl	1.00		
$ZnCl_2$	1.00		

a: Inferred from a comparison of the ICP and SMPS measurements. The excess volume measured with the SMPS, corrected for the known density of the salt and its most common hydrate, was assumed to be due to water in the hydrate. From this the mole fractions of the two forms were inferred.

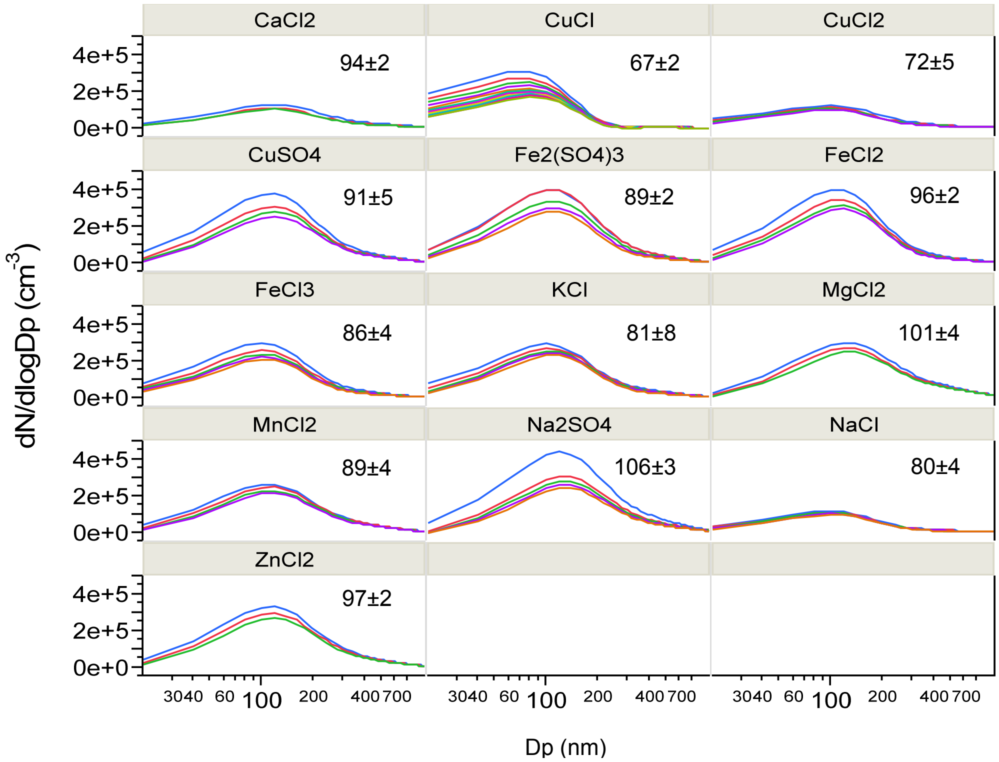

Figure S1: Number size distributions of metal salts in the chamber during the sampling period.

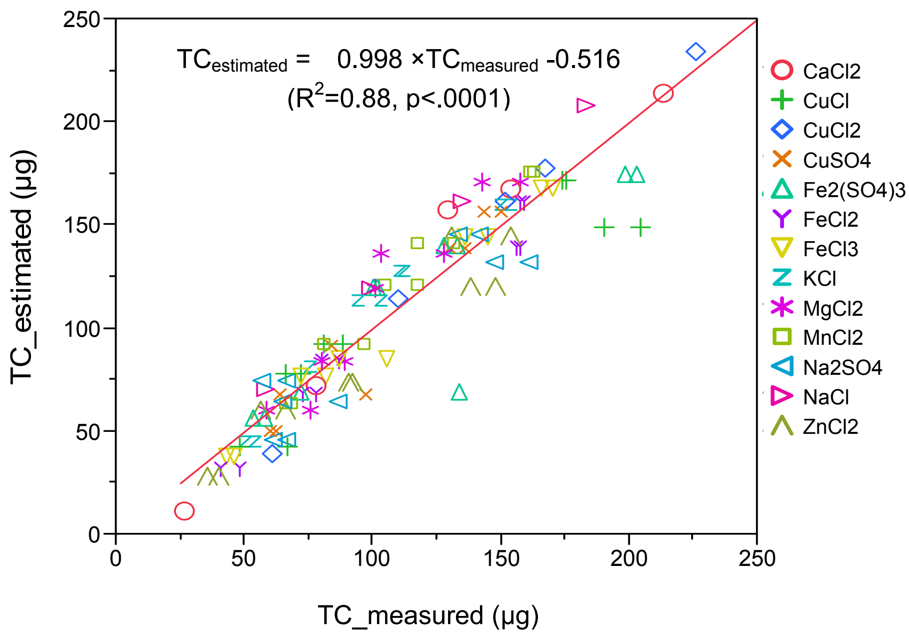

Figure S2: The relationship between measured total carbon (TC) by TOEGA and estimated TC for metal-loaded diesel samples. Estimated TC was calculated from the BC concentration measured by optical transmissometer and linear relationship between TC and BC, TC (µg)= 1.78 ×BC(µg) - 21.97, derived from diesel reference samples.

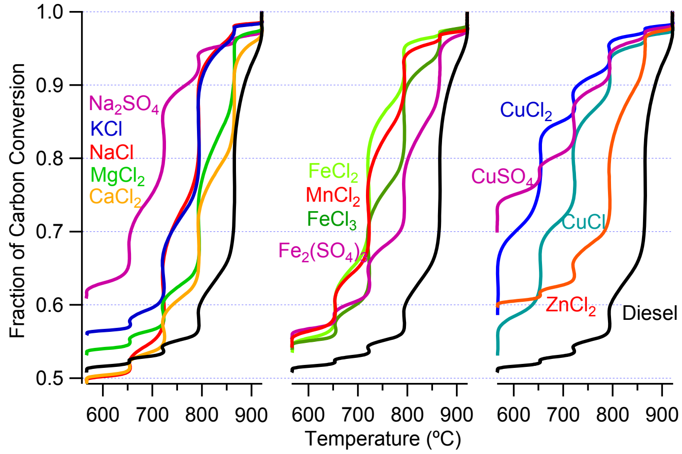

Figure S3: Average carbon conversion profiles of diesel and metal-loaded diesel samples in the He/O_2-phase of TOEGA. All the metal catalysts lower the temperature at which >60% conversion (oxidation) of diesel carbon was achieved.

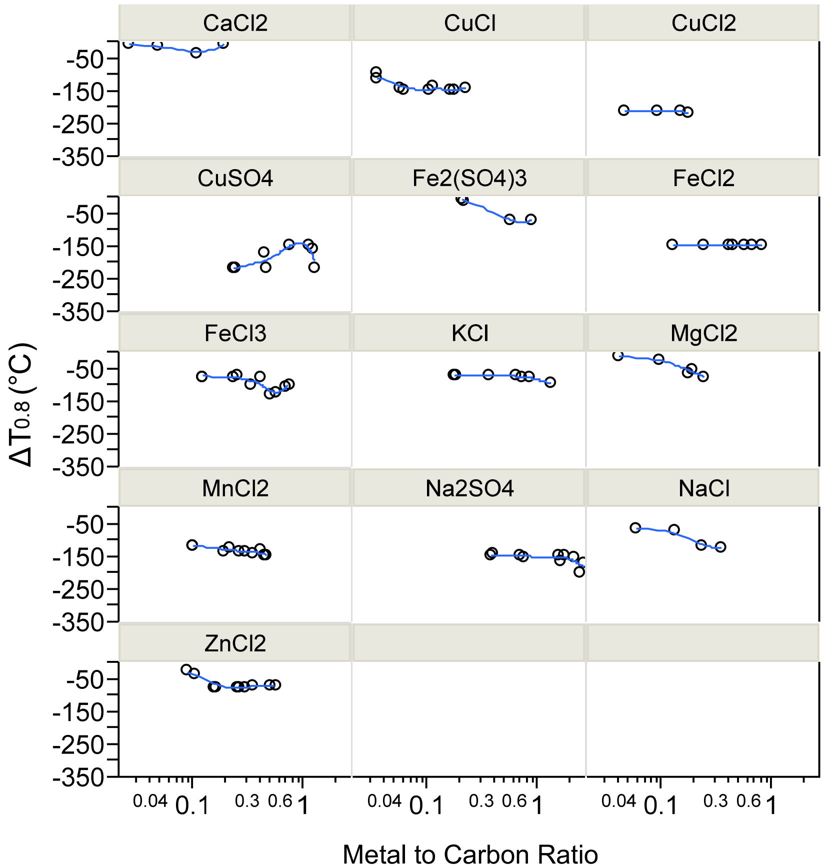

Figure S4: Reduction of $T_{0.8}$ (temperature when 80% carbon evolves from filter) as a function of metal to carbon ratio for metal-loaded diesel compared to diesel reference samples. The effect of metal catalysts on the soot oxidation temperature is mostly independent on the metal loading.

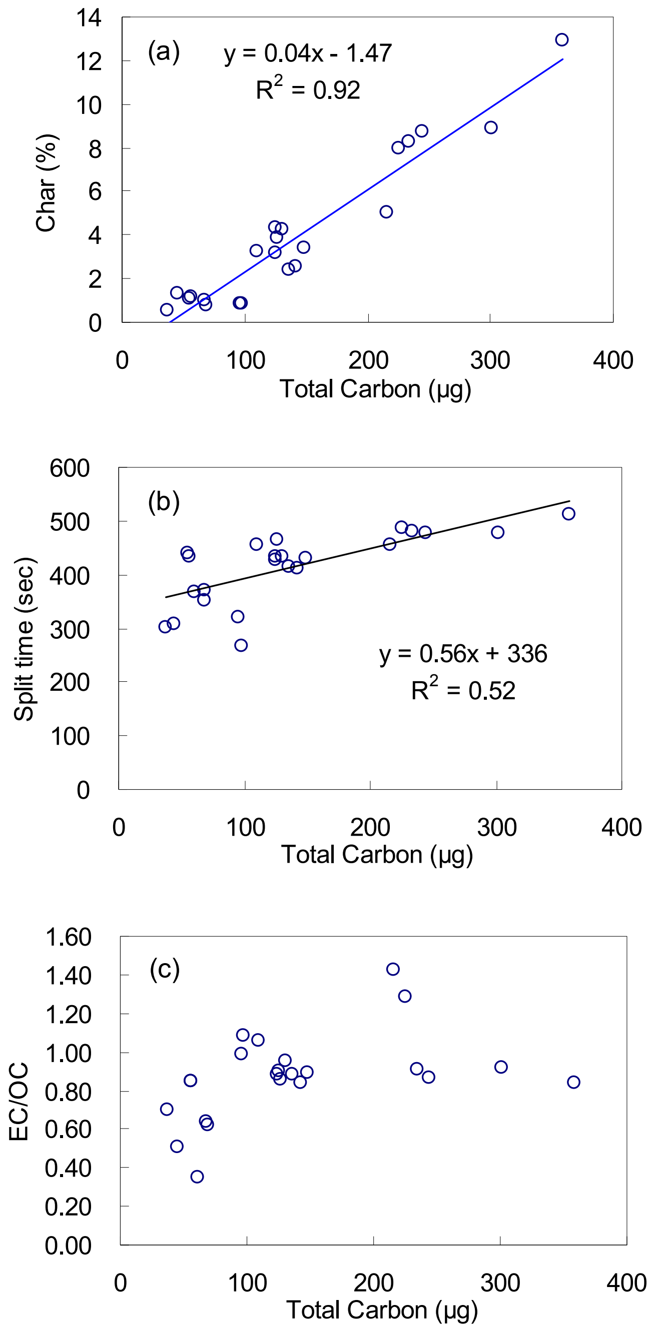

Figure S5: The relationship between char (a), OC-EC split time (b), EC/OC ratio (c), and total carbon content for diesel control samples.

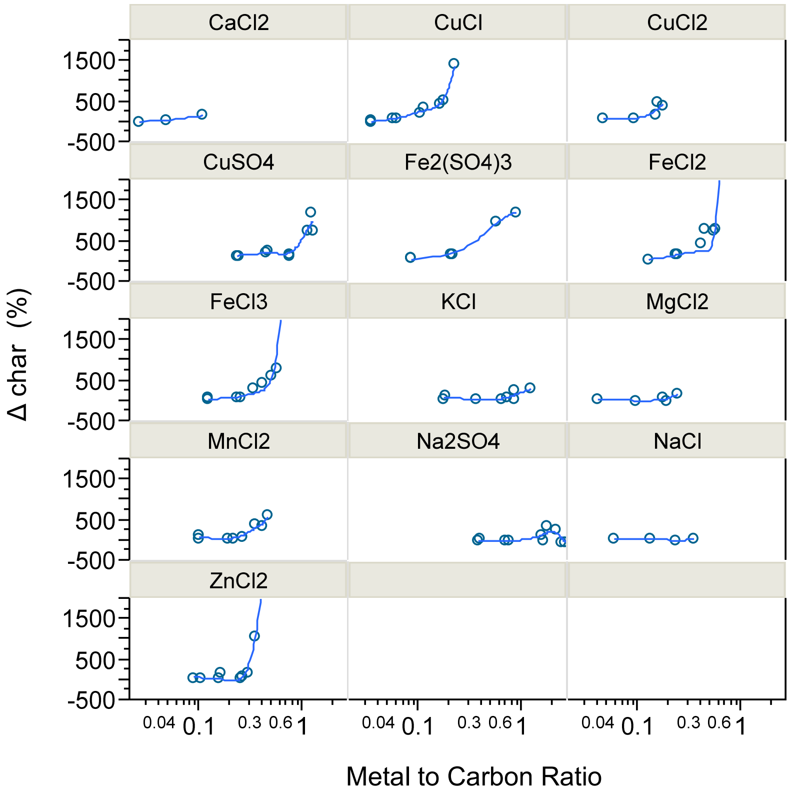

Figure S6: Percent increase of char as a function of metal to carbon ratio for metal-loaded diesel compared to diesel reference samples. The values have been adjusted for the effect of TC. The y axis represents $([char]_{\text{metal-loaded diesel sample}}-[char]_{\text{diesel reference sample with matched TC loading}})/[char]_{\text{diesel reference sample with matched TC loading}} \times 100$. Char: the percent reduction of laser transmittance through the filter during the inert heating phase of TOEGA.

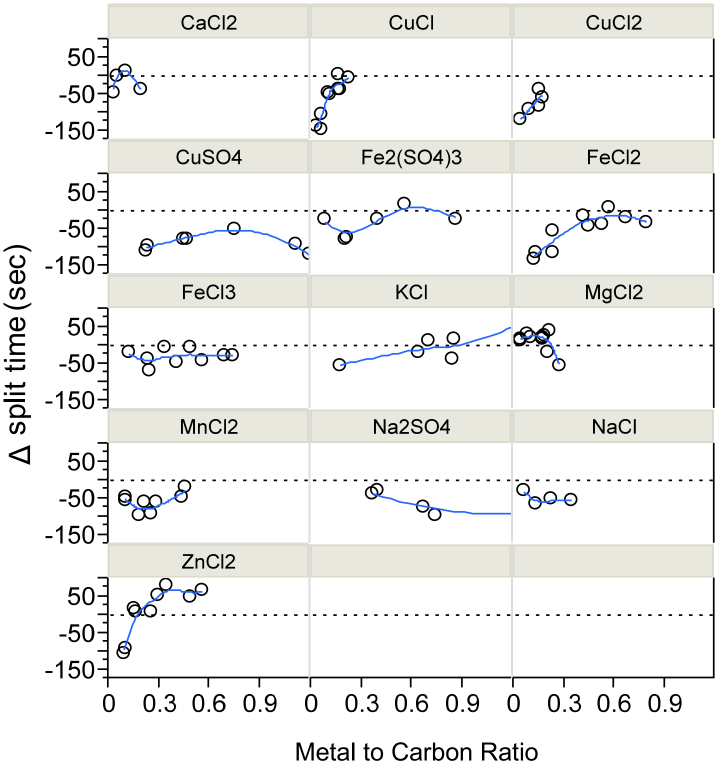

Figure S7: Change of OC-EC split time as a function of metal to carbon ratio for metal-loaded diesel compared to diesel reference samples. The values have been adjusted for the effect of TC on OC-EC split time.