

Electronic Supplementary Data (ESI)

Photocatalytic degradation of paraquat dichloride over CeO₂-modified TiO₂ nanotubes and the optimization of parameters by response surface methodology.

Naimat Abimbola Eleburuike^a, Wan Azelee Wan Abu Bakar^{a*} Rusmidah Ali^a and Muhammad Firdaus Omar^b

Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia.

Table S1 The independent variables with their coded factors and levels

Independent Variable	Coded Factor	Levels and Range		
		-1	0	1
Calcination temperature (°C)	X ₁	600	700	800
Catalyst loading (g)	X ₂	0.2	0.3	0.4
CeO ₂ ratio	X ₃	5	10	15

Table S2 XRD Crystallite size of catalysts

Catalyst	Crystallite Size (nm)
TNP 500 °C	23.51
TNT 500 °C	27.43
Ce-TNTs 500 °C	20.58
TNTs 760 °C	40.51
Ce-TNTs 760 °C	32.91

Fig. S1 Nitrogen adsorption-desorption isotherms and the pore size distribution of catalysts.

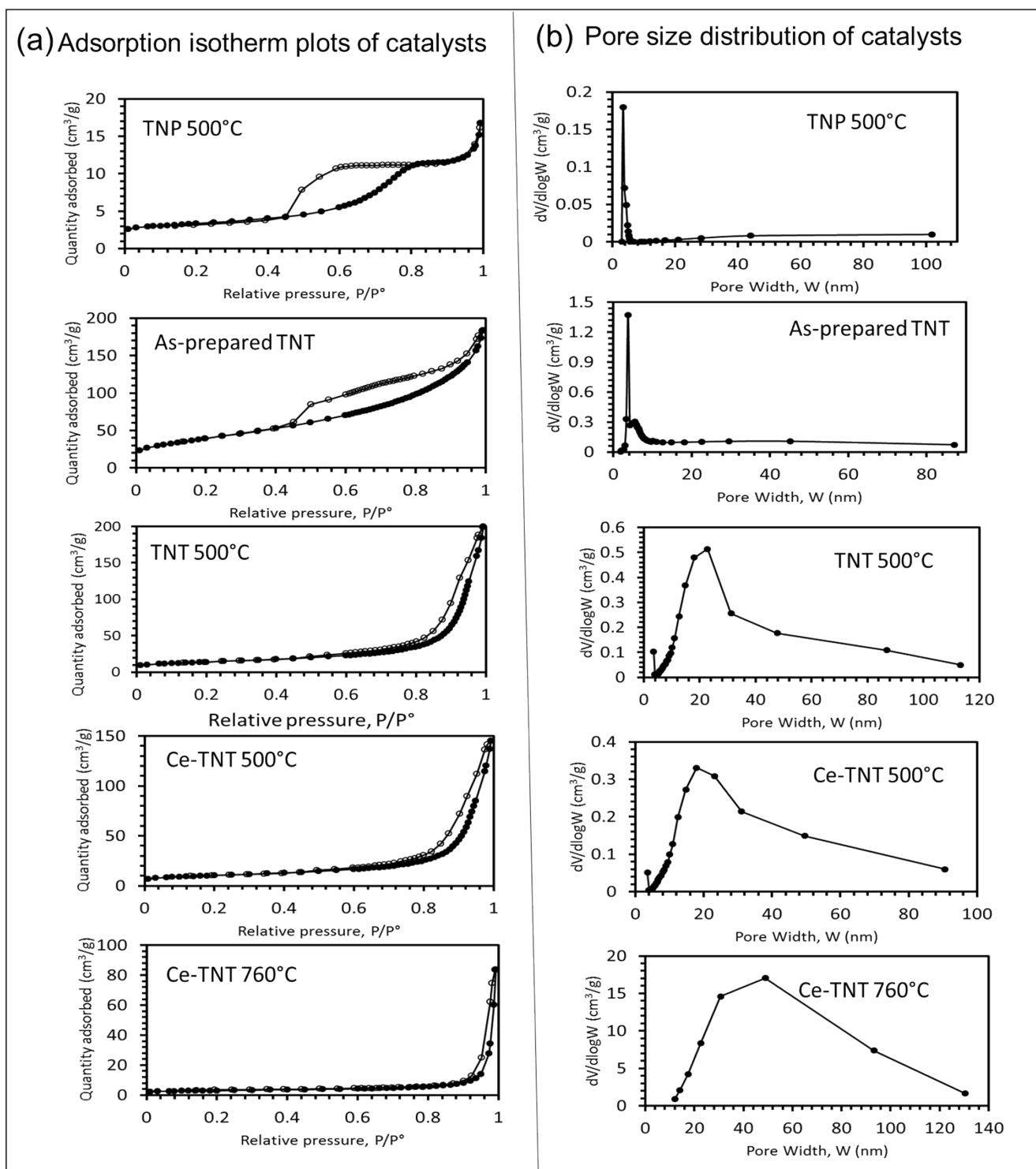


Fig. S2 The profile of FFT of CeO₂ showing the measured lattice spacing

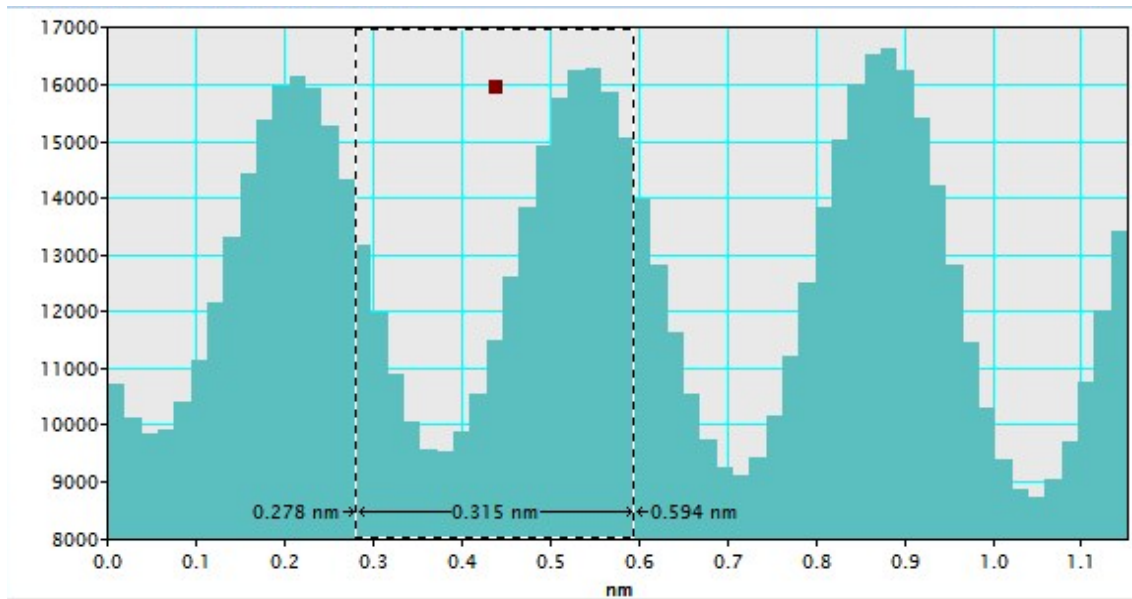


Fig. S3 EDX spectra of Ce-TNTs calcined at 500 °C

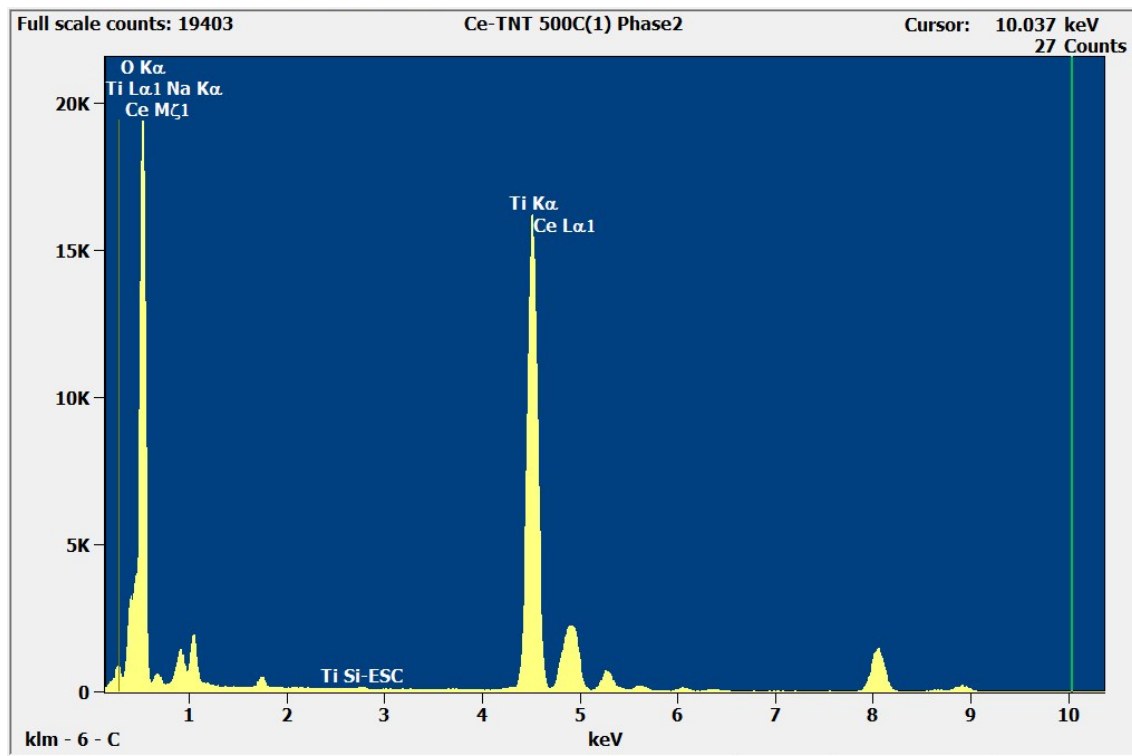


Fig. S4 EDX spectra of Ce-TNTs calcined at 760 °C

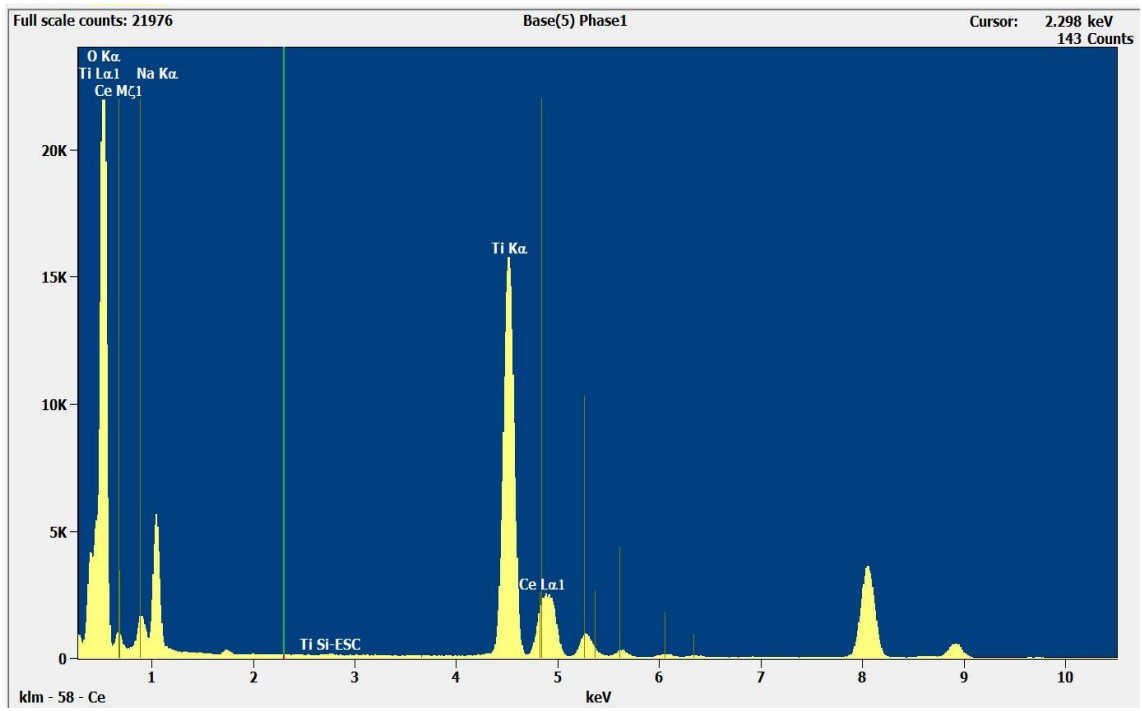


Fig. S5 (a) The FFT of STEM of Ce-TNTs

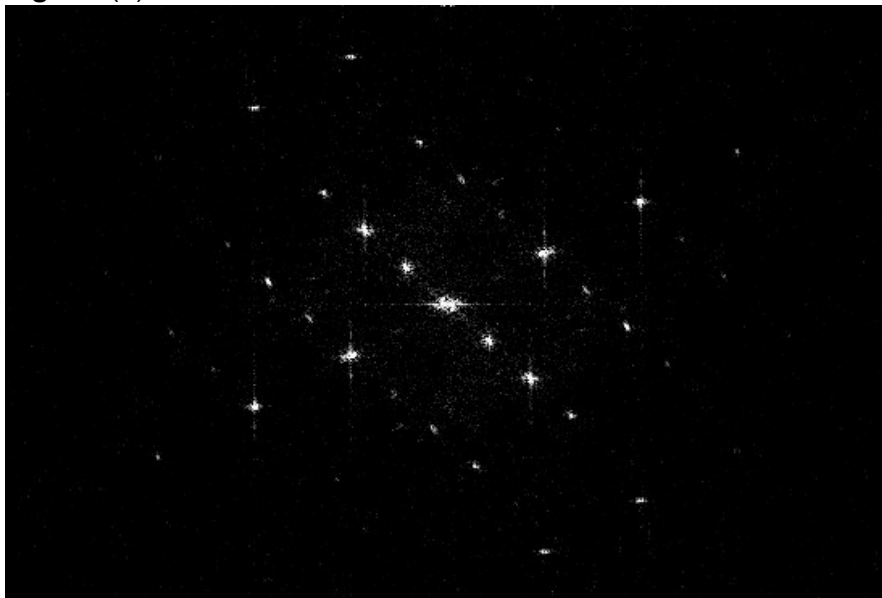


Fig. S5 (b) The profile of TNTs part in STEM of Ce-TNTs

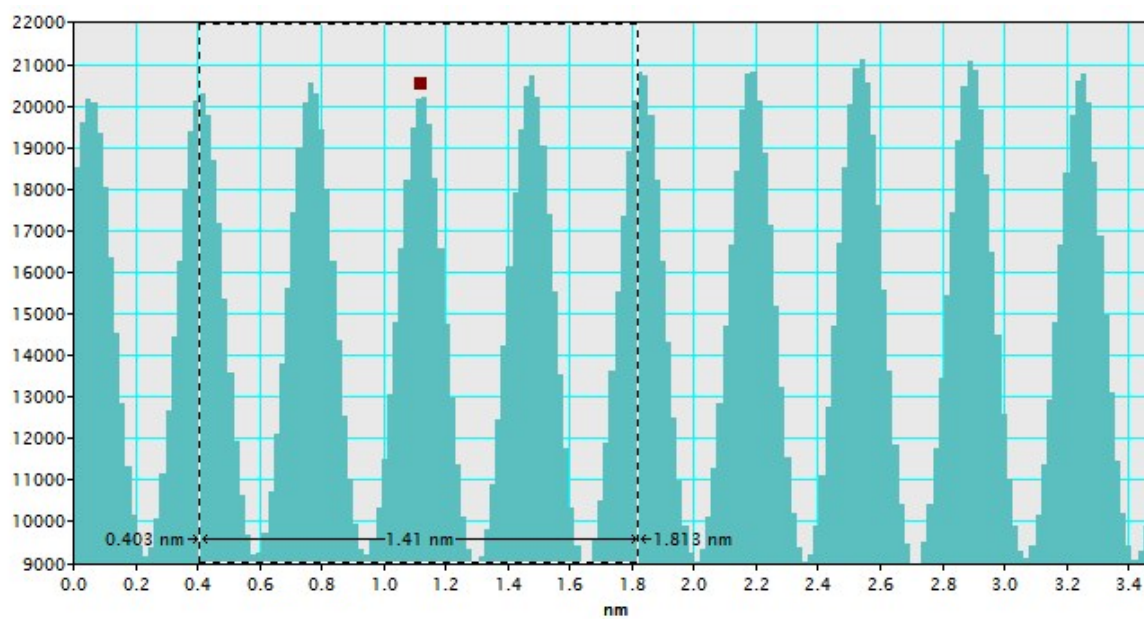


Fig. S6 EELS Spectra of TNTs calcined at 500 and 700 °C used as reference

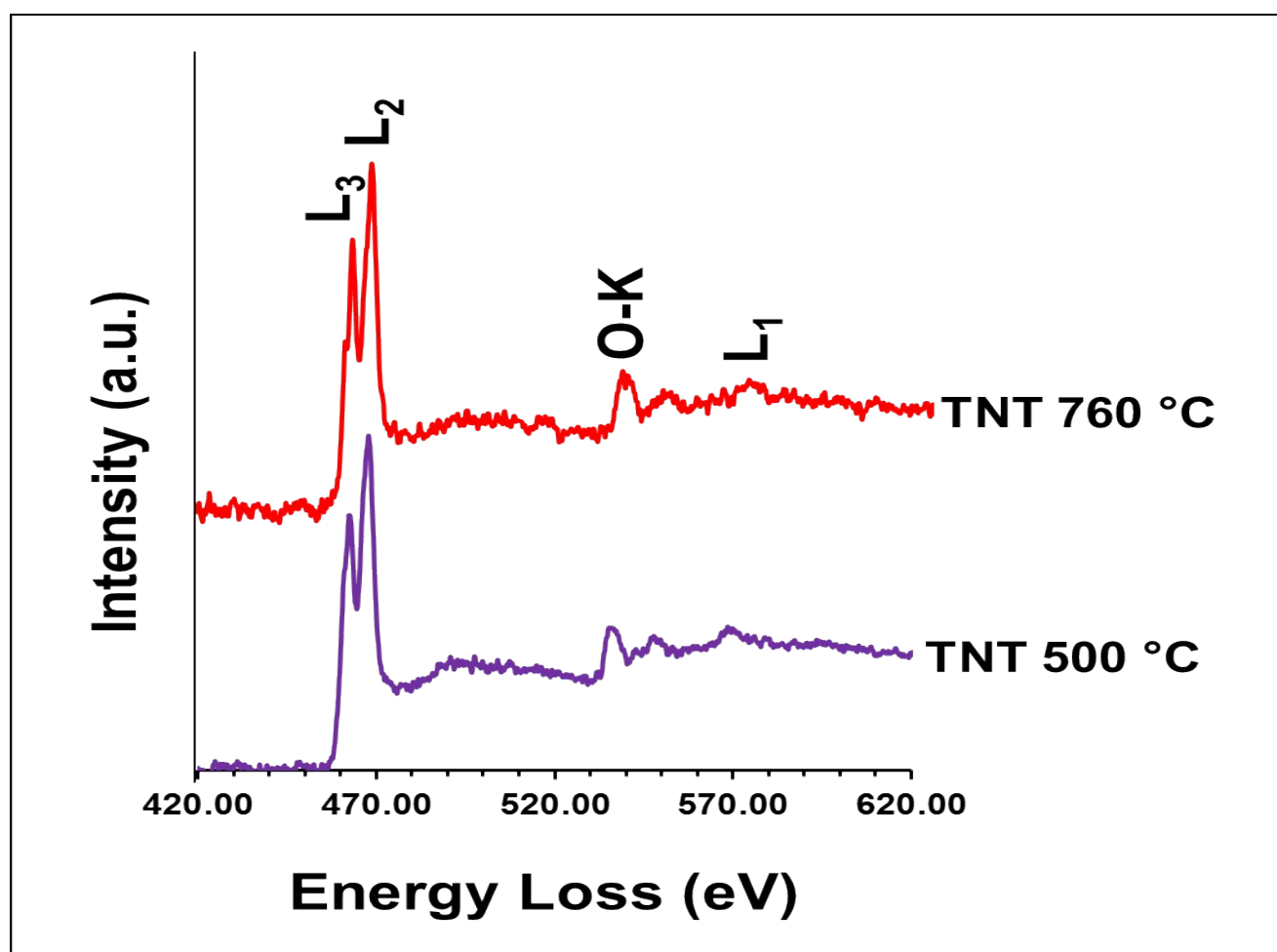


Fig. S7 EELS Spectra of CeO₂ calcined at 500 and 700 °C used as reference

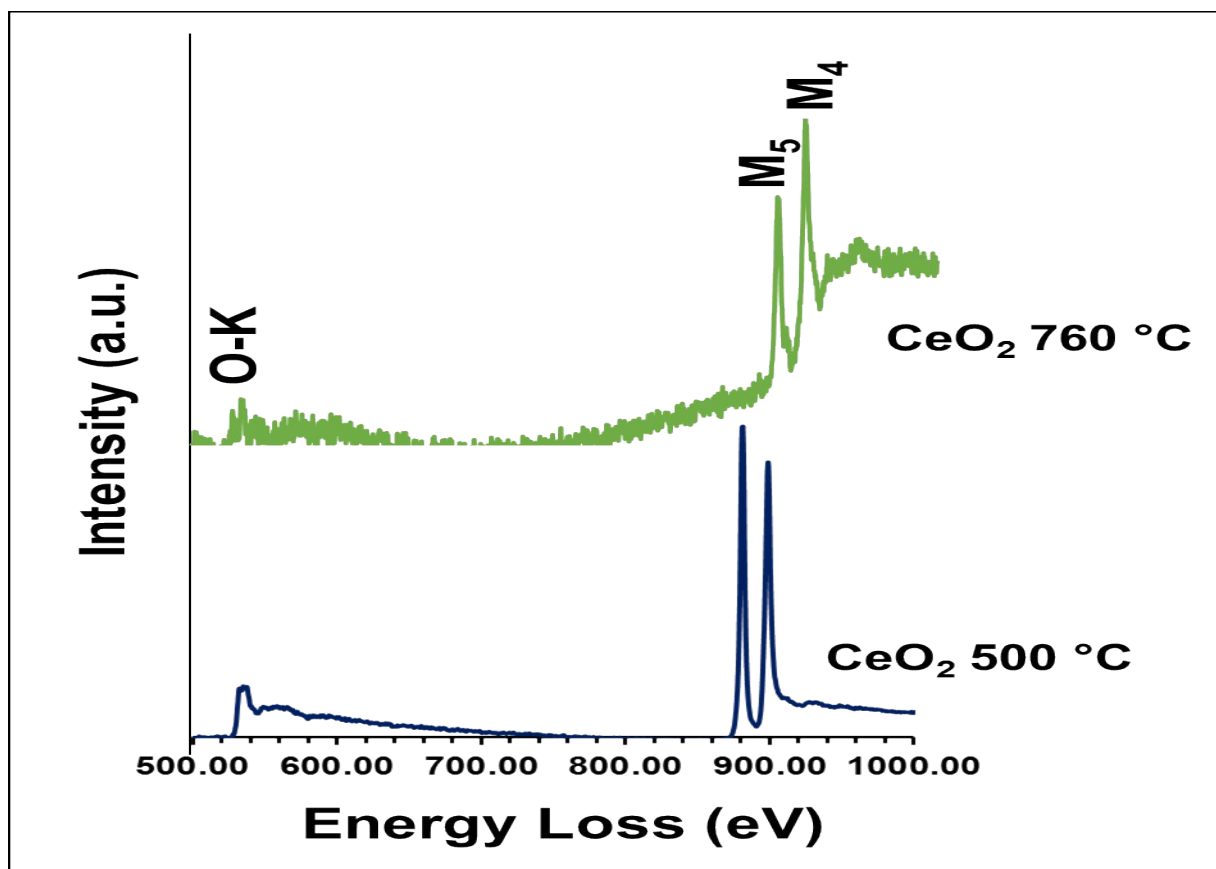


Fig. S8 A plot of the different type of residuals considered in evaluating the fitness of the quadratic model for predicting the optimum response.

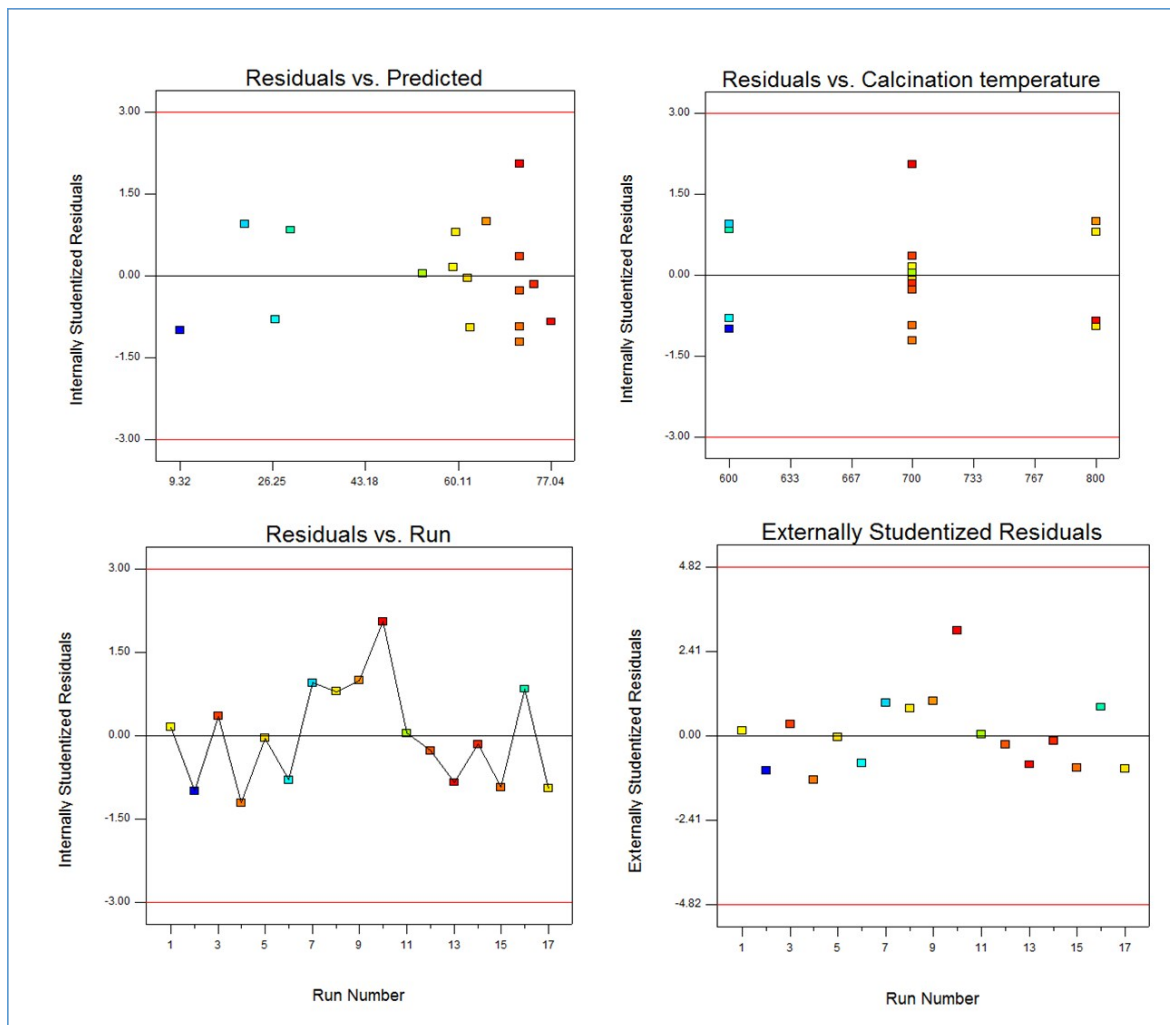


Fig. S9 Contour plots of the interactions between calcination temperature and catalyst loading at a fixed CeO₂ ratio of 10 %.

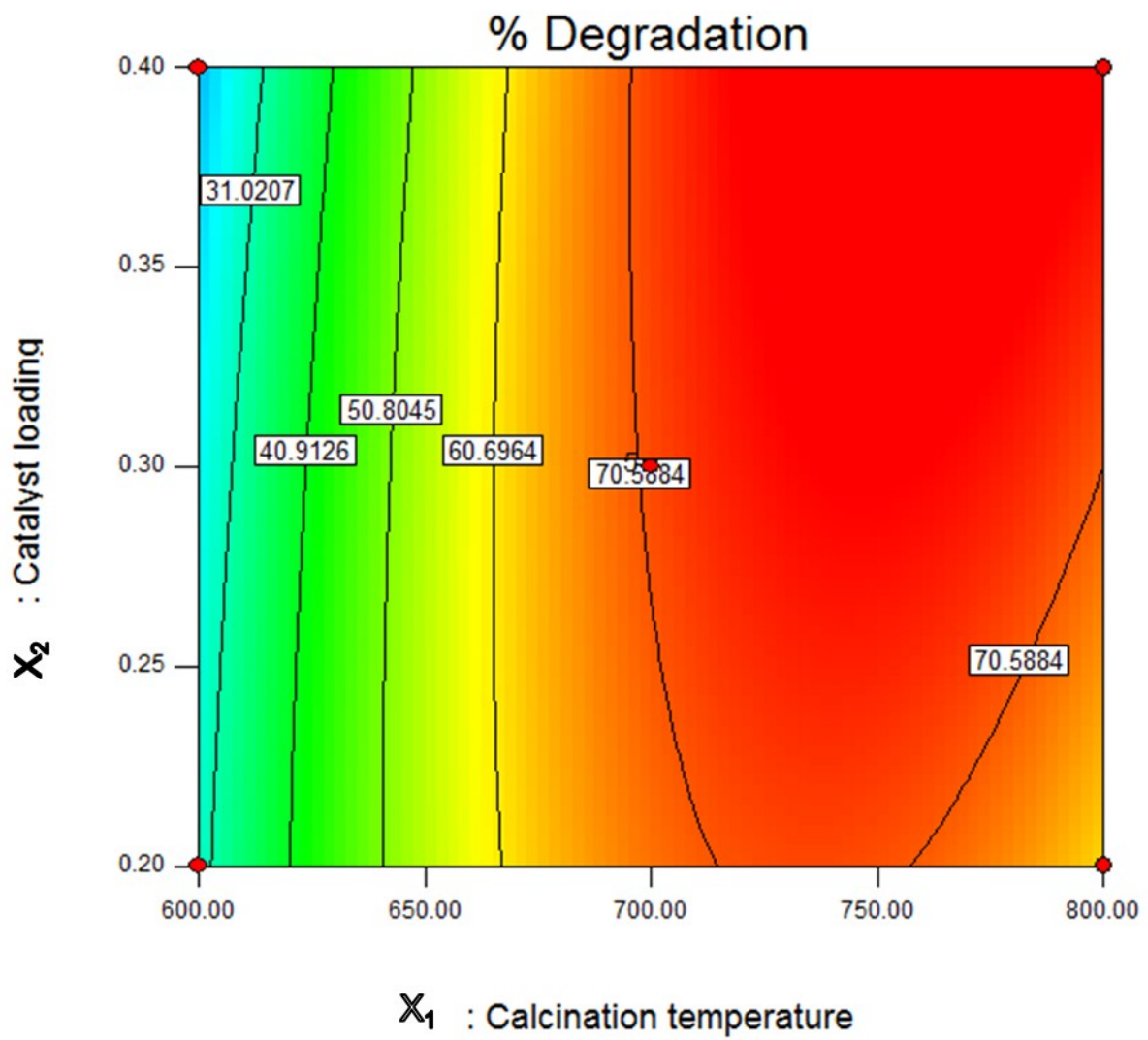


Fig. S10 Contour plots of the interactions between calcination temperature and CeO₂ ratio at a fixed catalyst loading of 0.3 g.

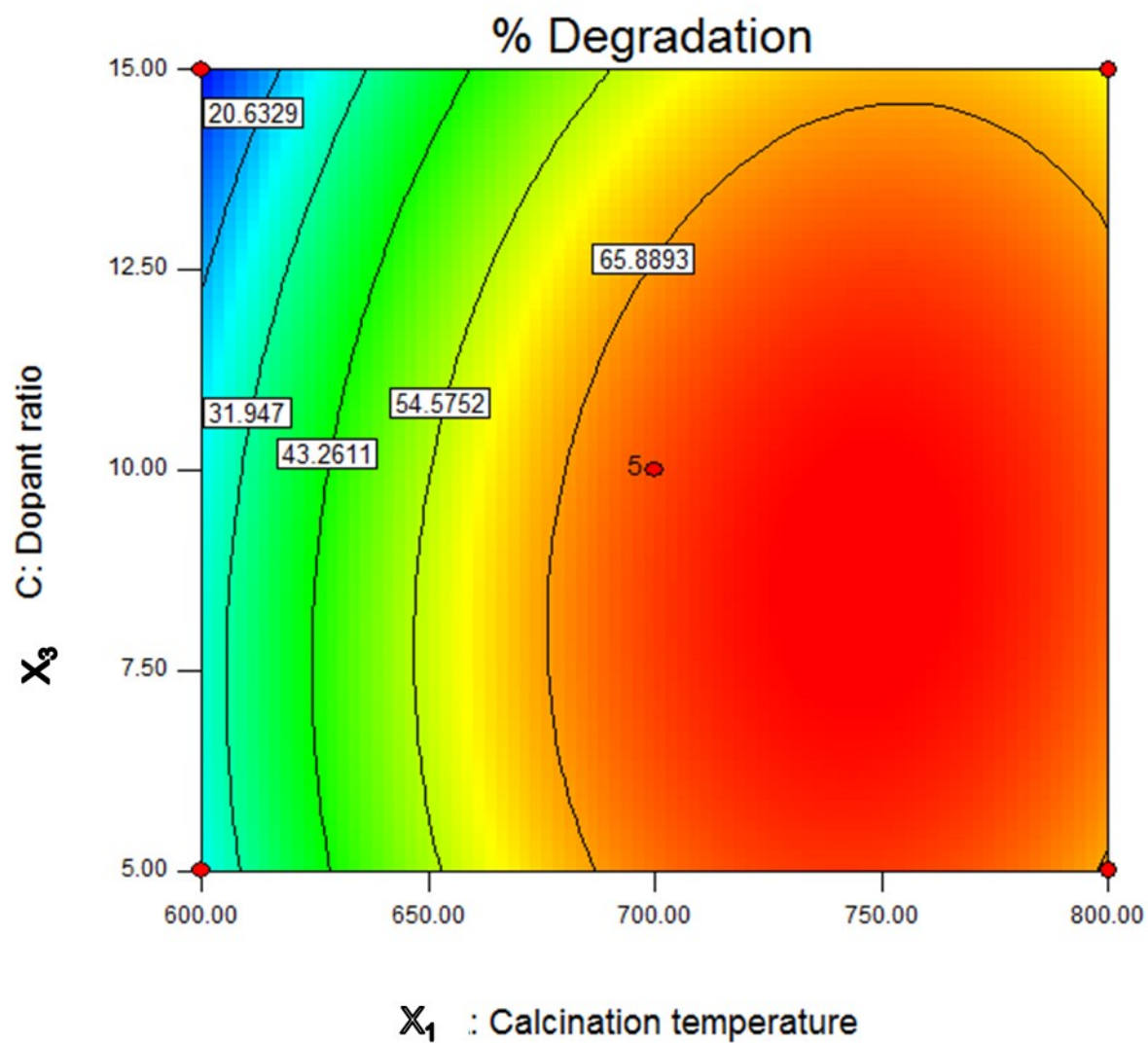


Fig. S11 Contour plots of interactions between catalyst loading and CeO₂ ratio at a fixed calcination temperature of 700 °C.

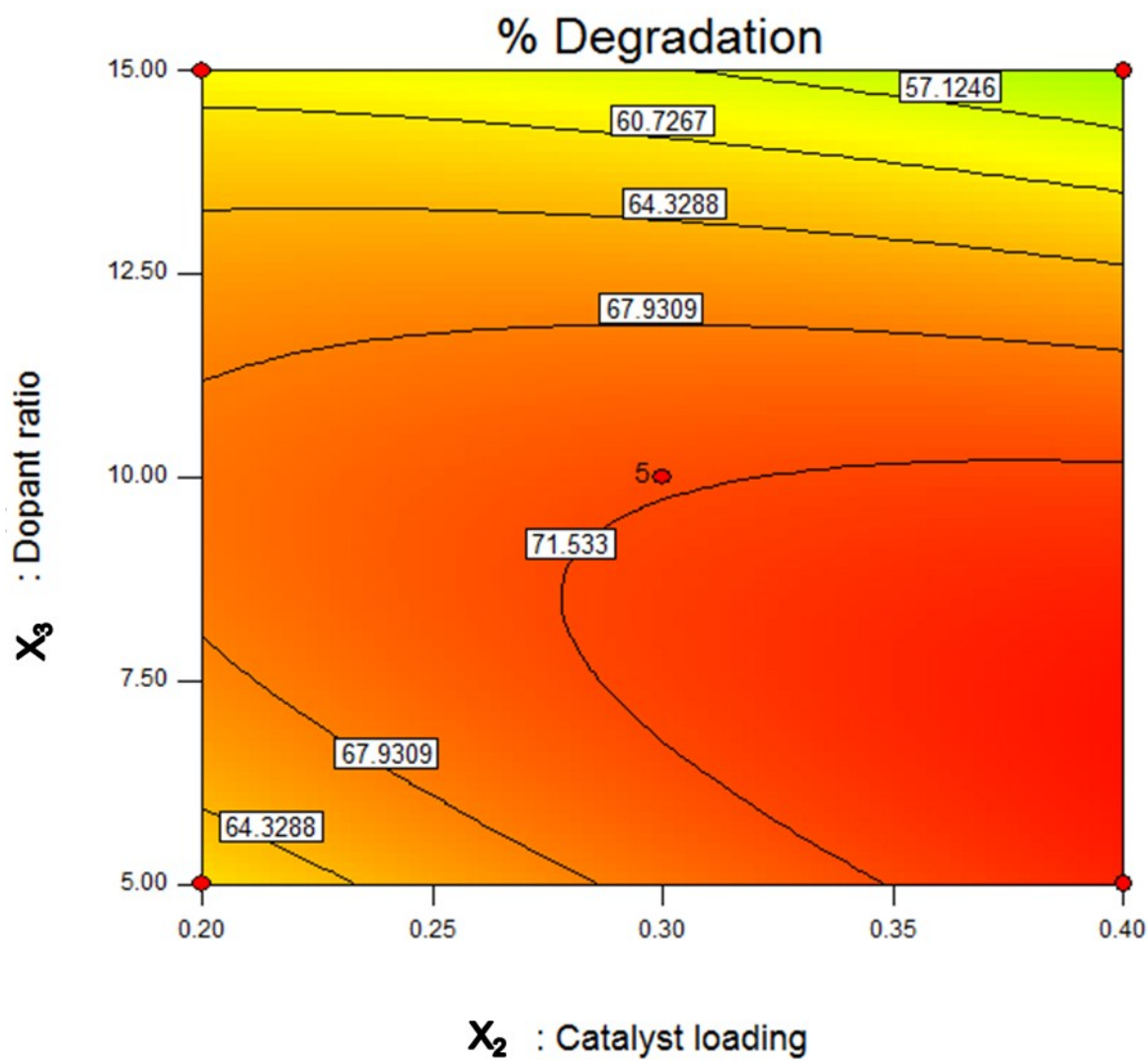
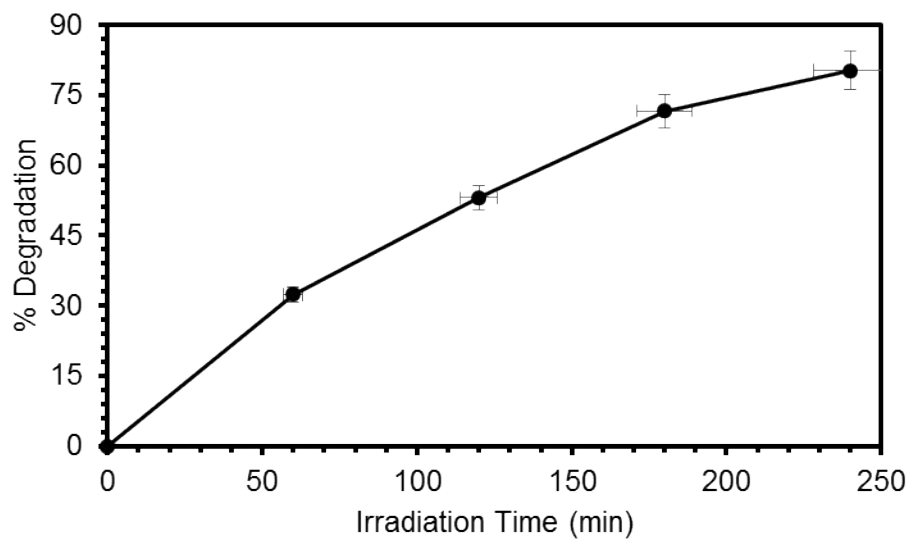


Fig. S12 Rate of degradation of PQ with time under the optimized conditions

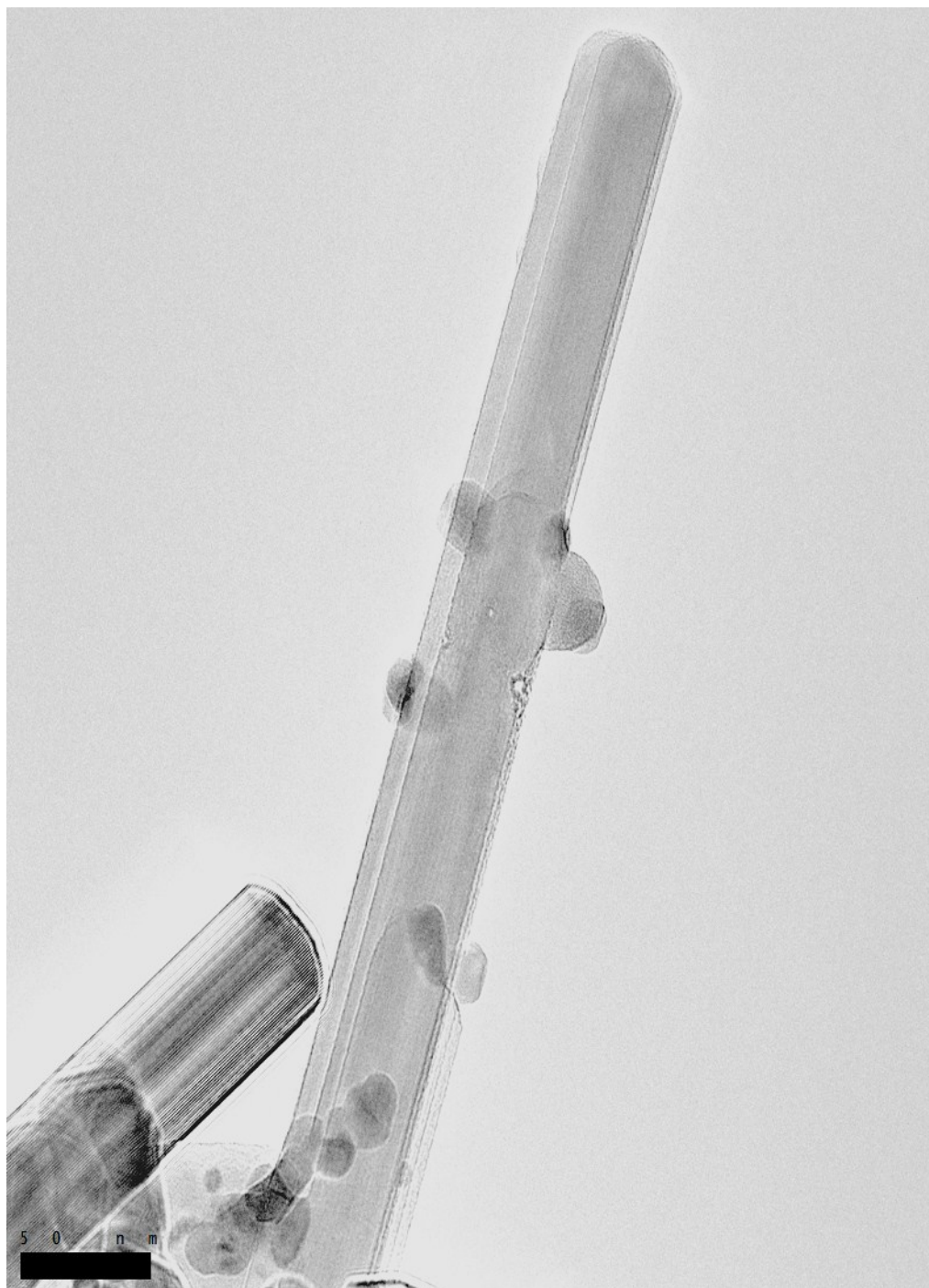


Clear TEM Micrographs

TEM Image of Ce-TNTs, 500 °C shown in Figure 2a



TEM Image of Ce-TNTs, 760 °C shown in Figure 2c



TEM Images of Ce-TNTs showing the surface attachment of CeO₂ on the TNTs.

