

Supplementary Information for:

**Multi-step polymer degradation kinetics using activation energy-
dependent cataluminescence**

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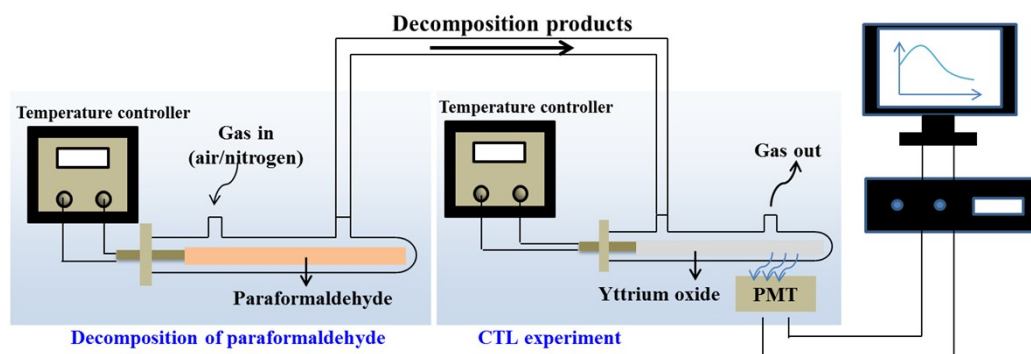


Fig. S1. Schematic representation of the CTL system.

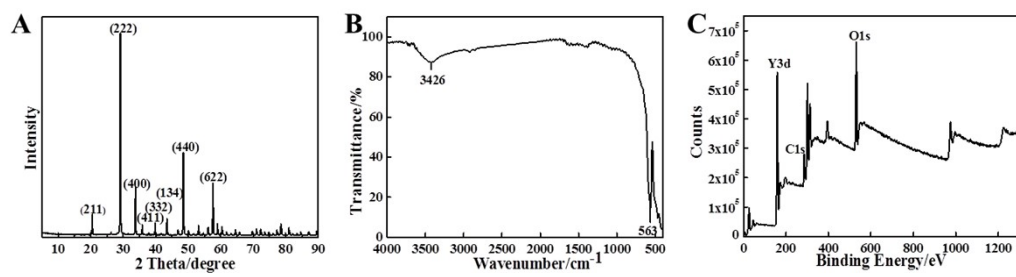


Fig. S2. (A) XRD pattern, (B) FT-IR transmittance spectrum and (C) XPS spectrum of yttrium oxide particles.

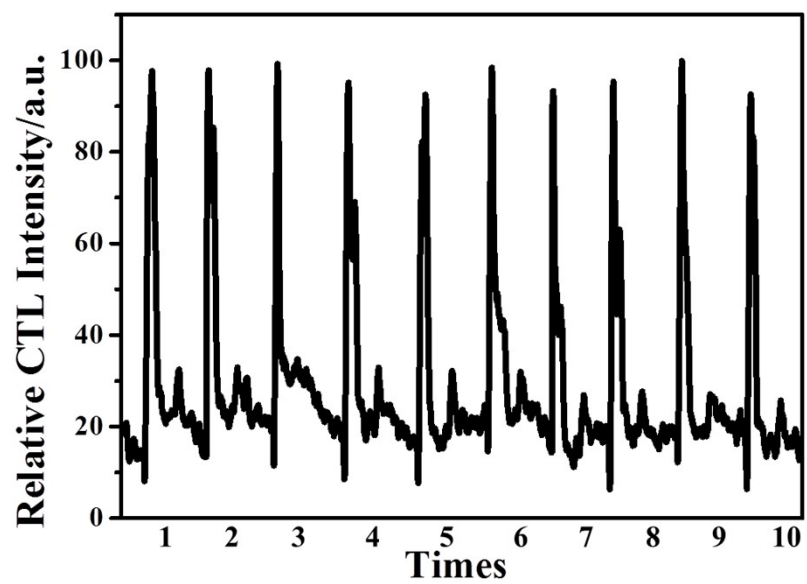


Fig. S3. Reproducibility of the CTL intensity of formaldehyde (40 mM) under 165 °C catalyzed by yttrium oxide.

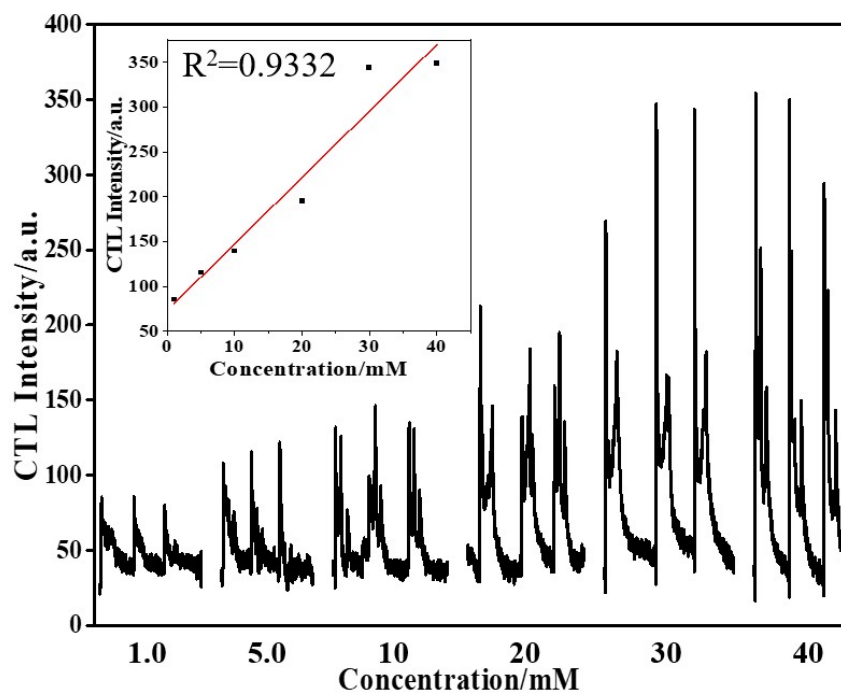


Fig. S4. Relationship between the concentrations of formaldehyde and the CTL intensity catalyzed by yttrium oxide, and the inset showed the linearity in the range of 1.0 to 40.0 mM.

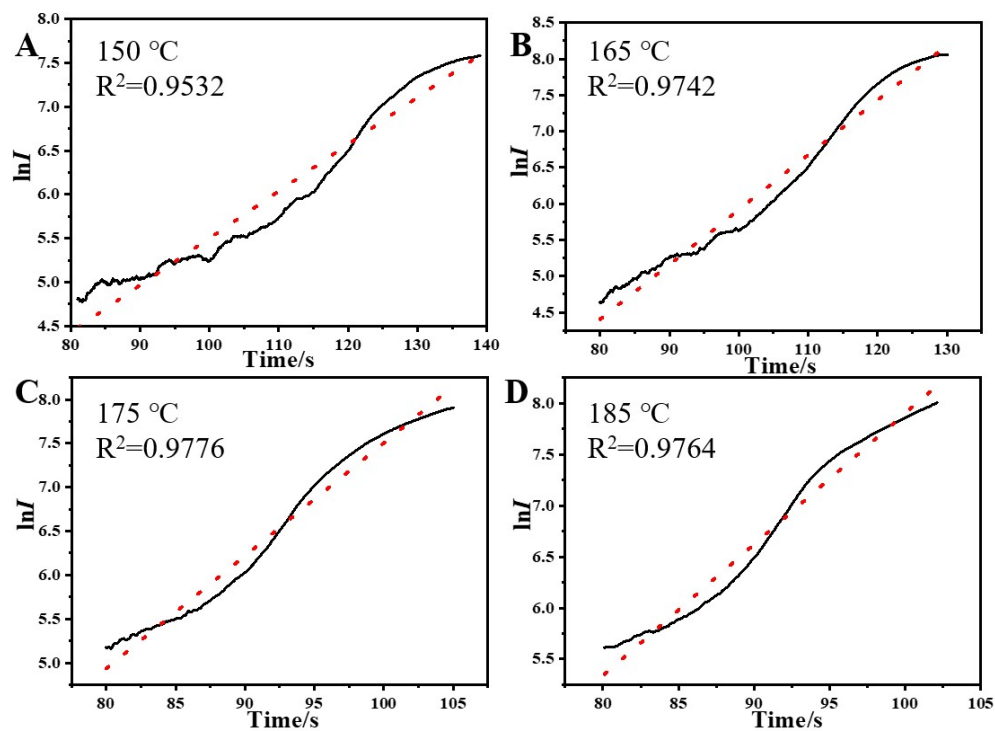


Fig. S5. Linear fitting curves of the CTL intensity (I) and time (t) for the first peak in the thermal degradation of POM in air under different temperatures: (A) 150 °C, (B) 165 °C, (C) 175 °C and (D) 185 °C.

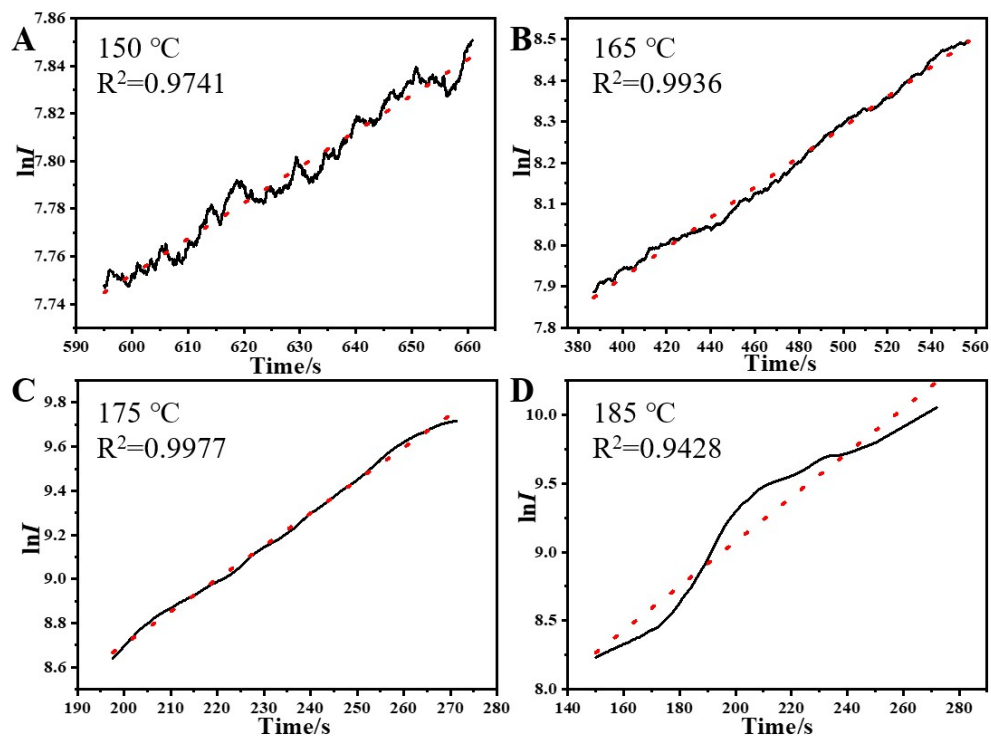


Fig. S6. Linear fitting curves of the CTL intensity (I) and time (t) for the second peak in the thermal degradation of POM in air under different temperatures: (A) 150 °C, (B) 165 °C, (C) 175 °C and (D) 185 °C.

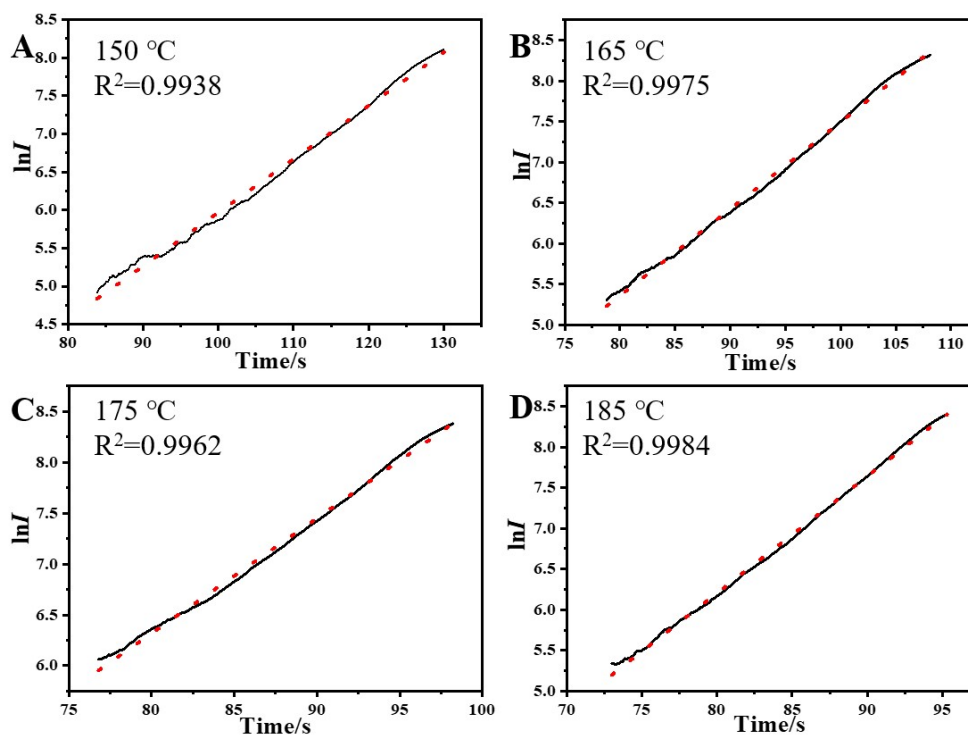


Fig. S7. Linear fitting curves of the CTL intensity (I) and time (t) for the first peak in the thermal degradation of POM in nitrogen under different temperatures: (A) 150 °C, (B) 165 °C, (C) 175 °C and (D) 185 °C.

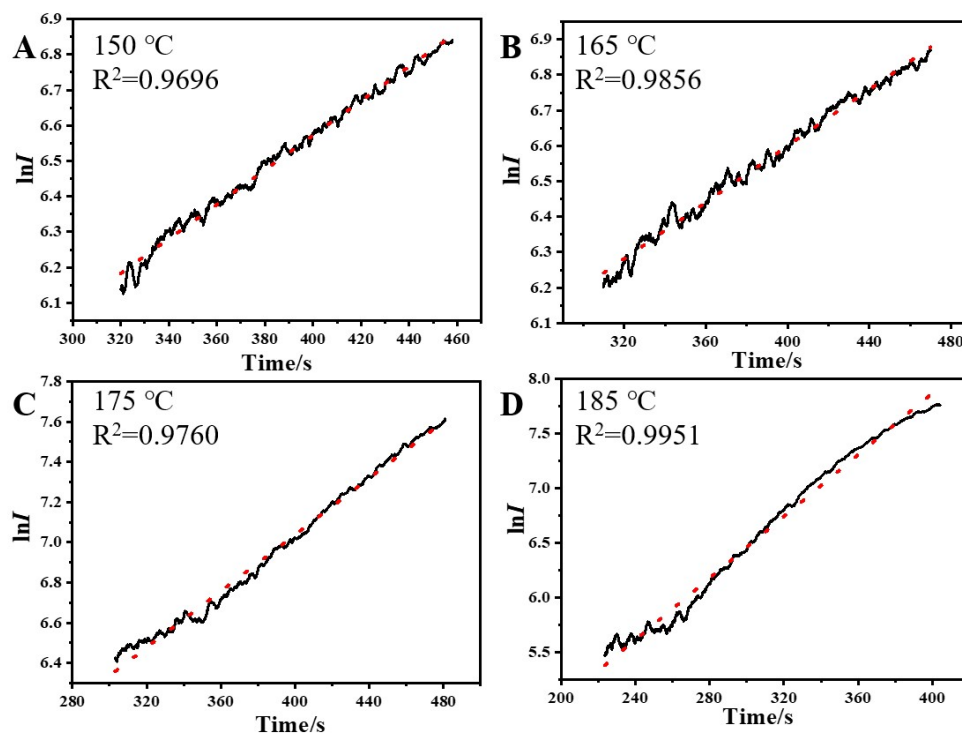


Fig. S8. Linear fitting curves of the CTL intensity (I) and time (t) for the second peak in the thermal degradation of POM in nitrogen under different temperatures: (A) 150 °C, (B) 165 °C, (C) 175 °C and (D) 185 °C.

Table S1. The relationship between the heating voltages and corresponding temperatures.

Heating voltage/V	Temperature/°C
95	150
100	165
110	175
115	185

Table S2. The k values of the two step reactions under different temperatures in air.

Temperature/°C	k_1/s^{-1}	k_2/s^{-1}
150	0.0536	0.0015
165	0.0757	0.0037
175	0.1285	0.0149
185	0.1281	0.0162

Table S3. The k values of the two step reactions under different temperatures in nitrogen.

Temperature/°C	k_1/s^{-1}	k_2/s^{-1}
150	0.0702	0.0049
165	0.1067	0.0040
175	0.1133	0.0070
185	0.1435	0.0141