

Description of Additional Supplementary Files

File Name: Supplementary Movie 1

Description: Particle dynamics at 600 °C during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 2

Description: Particle dynamics at 700 °C during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 3

Description: Particle dynamics at 800 °C during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 4

Description: Hindered particle dynamics due to the formation of carbon materials during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 5

Description: Particle dynamics at 900 °C during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 6

Description: Particle dynamics at 950 °C during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 7

Description: Electron diffractions at 700 °C during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 8

Description: Electron diffractions at 800 °C during an O₂-lean ethylene oxidation reaction

File Name: Supplementary Movie 9

Description: Atomic-scale observation of oscillatory phase transitions of a Cu nanoparticle at 700 °C during an O₂-lean ethylene oxidation reaction