# LIST OF SYMBOLS

## LIST OF ABBREVIATIONS

| | |
|---|---|
| AAS | Atomic absorption spectrophotometer |
| A/F | Air to fuel ratio |
| Atm. | Atmosphere |
| BET | Brunauer, Emmett and Teller |
| BS | Bharat stage |
| Cat | Catalyst |
| CI | Compression ignition |
| CuMnOx | Copper manganese oxide |
| CNG | Compressed natural gas |
| CO | Carbon monoxide |
| DPF | Diesel particulate filter |
| DPM | Diesel particulate matter |
| EDX | Energy dispersive X-ray analysis |
| EGR | Exhaust gas recirculation |
| EPA | Environmental Protection Agency (US)/Environmental Pollution (Prevention and Control) Authority (India) |
| EPM | Exhaust particulate matter |
| Fig. | Figure |
| FTIR | Fourier transform infrared spectroscopy |
| g | Gram |
| GOI | Government of India |
| GC | Gas chromatograph/Gas chromatography |
| GHSV | Gas hourly space velocity |
| HC | Hydrocarbon |
| HEV | Hybrid electric vehicle |
| h | Hour |

| | |
|---|---|
| IC | Internal combustion |
| kmph | Kilometer per hour |
| LEV | Low emission vehicle |
| L-H | Langmuir Hisnshelwood |
| LPG | Liquefied petroleum gas |
| mph | Miles per hour |
| mol | Mole |
| NAAQS | National ambient air quality standards |
| NAAQMS | National ambient air quality monitoring series |
| NOx | Nitrogen oxides |
| NOx-HC-SCR | NOx-Hydrocarbon-Selective Catalytic Reduction |
| OSC | Oxygen storage capacity |
| PGM | Platinum-group metals |
| PMi | Particulate matter (of size $\leq$ i μm) |
| PPM | Parts per million |
| Redox | Reduction-oxidation |
| SCR | Selective catalytic reduction |
| SEM | Scanning electron microscope |
| SI | Spark ignition |
| SPM | Suspended particulate matter |
| TGA | Thermo-gravimetric analysis |
| TLEV | Transitional low emission vehicle |
| TWCC | Three-way catalytic converter |
| VOC | Volatile organic compound |
| WHSV | Weight hourly space velocity |
| XRD | X-ray diffraction |
| ZEV | Zero emission vehicle |

# LIST OF NOTATIONS

| | |
|---|---|
| A | Pre-exponential factor (in Arrhenius equation) or frequency factor |
| $C_{CO}$ | Concentration of CO |
| E | Activation energy |
| $F_{CO}$ | Molar feed rate of CO |
| k, k’ | Rate constants |
| l, m, n | Order of reaction |
| r | Rate of reaction per unit mass of catalyst |
| $r_{obs}$ | Observed rate of reaction per unit mass of catalyst |
| R | Universal gas constant |
| $S_{BET}$ | BET surface area |
| V | Volume of adsorbate |
| W | Mass of catalyst |
| T | Temperature |
| $\lambda$ | X-ray wavelength |
| $\theta$ | Bragg’s angle |
| $\beta$ | Full width half maximum |
| $X_{CO}$ | Fractional conversion of CO |
| RT | Retention time |

# LIST OF SUBSCRIPTS

| | |
|---|---|
| a | Catalyst produced by calcination in stagnant air |
| fa | Catalyst produced by calcination in flowing air |
| r | Catalyst produced by reactive calcination |