# LIST OF ABBREVIATION AND SYMBOLS

| | |
|---|---|
| % | percentage |
| °C | degree centigrade |
| 0-D | zero dimensional |
| 1-D | one dimensional |
| 2-D | two dimensional |
| 3-D | three dimensional |
| AC | alternating current |
| APTES | (3-Aminopropyl)triethoxysilane |
| ASTM | American society for testing and materials |
| ATR | attenuated total reflection |
| BD | 1,4-butanediol |
| BET | Brunauer-Emmett-Teller |
| BJH | Barrett-Joyner-Halenda |
| BLPU | bio-based linear polyurethane |
| BPA | bisphenol-A |
| BTI | bitolylene diisocyanate |
| ca. | circa |
| CB | conduction band |
| CBED | convergent beam electron diffraction |
| CD | carbon dot(s) |
| cm | centimeter(s) |
| CNC | cellulose nanocrystal(s) |
| CNT | carbon nanotube(s) |
| CO | castor oil |
| COMP | castor oil modified polyol |
| CQD | carbon quantum dot(s) |
| DABCO | 1,4-Diazabicyclo[2.2.2.]octane |
| DB | degree of branching |
| DBTDL | dibutyltin dilaurate |
| DBTDA | dibutyltin diacetate |
| DBU | 1,8-Diazabicyclo[5.4.0]unde-7-ene |
| DDI | dimer acid diisocyanate |
| DEA | diethanolamine |

| | |
|---|---|
| DGEBA | diglycedylether epoxy of bisphenol A |
| DMAc | dimethylacetamide |
| DMSO | dimethyl sulfoxide |
| DMF | dimethylformamide |
| DPP | diphenyl phosphate |
| DSC | differential scanning calorimetry |
| $e^-$ | electron(s) |
| *E. Coli* | *Escherichia coli* |
| EIS | electrochemical impedance spectroscopy |
| EtOH | ethanol |
| eV | electron volt |
| fcc | face centered cubic |
| FFT | fast Fourier transform |
| FTIR | Fourier transform infrared |
| g | gram(s) |
| GC | gas chromatography |
| g-CN | graphitic-carbon nitride |
| g $mol^{-1}$ | gram per mole(s) |
| GPC | gel permeation chromatography |
| GO | graphene oxide |
| h | hour(s) |
| $h^+$ | hole(s) |
| HAp | hydroxyapatite |
| H-bonding | hydrogen bonding |
| HDI | hexamethylene diisocyanate |
| HPLC | high performance liquid chromatography |
| HPU | hyperbranched polyurethane(s) |
| HPUNC | hyperbranched polyurethane nanocomposite(s) |
| HRTEM | high resolution transmission electron microscopy |
| HTPB | hydroxyl-terminated polybutadiene glycol |
| Hz | Hertz |
| ICP | inductively coupled plasma |
| IFFT | inverse fast Fourier transform |
| IPDI | isophorone diisocyanate |
| *i*PrOH | isopropanol |
| IR | infrared |

| | |
|---|---|
| J | Joule |
| kg | kilogram(s) |
| kJ | kilo Joule |
| kV | kilo Volt |
| LDI | (*S*)-Lysine diisocyanate |
| LPU | linear polyurethane |
| lux | illuminance |
| MeCN | acetonitrile |
| MDI | methylene diphenyl diisocyanate |
| MGE | monoglyceride |
| min | minute(s) |
| mL | milli litre(s) |
| mm | milli meter(s) |
| mV | milliVolt(s) |
| MMT | montmorillonite |
| mol | mole(s) |
| MPa | mega Pascal |
| MPA | 2,2-Bis(hydroxymethyl)propionic acid |
| MSA | methane sulfonic acid |
| MW | microwave |
| MWCNT | multi-walled carbon nanotube(s) |
| N | Newton |
| NBDI | norbornane diisocyanate |
| NDI | naphthalene diisocyanate |
| NHC | *N*-heterocyclic carbene(s) |
| NIR | near IR |
| nm | nanometer |
| NMR | nuclear magnetic resonance |
| NP | nanoparticle(s) |
| OD | optical density |
| *P. aeruginosa* | *Pseudomonas aeruginosa* |
| *P. cepacia* | *Pseudomonas cepacia* |
| PBG | poly(xixolydimet oxide) glycol |
| PCL | poly(caprolactone)diol |
| PDI | polydispersity index |
| PDMS | polydimethylsiloxane |

| | |
|---|---|
| PEG | polyethylene glycol |
| PhMe | toluene |
| phr | parts per hundred rubber |
| PL | photoluminescence |
| PPG | poly(propylene oxide) glycol |
| ppm | parts per million |
| PHMEG | poly(hexamethylene oxide) glycol |
| PTMEG | poly(tetramethylene ether) glycol |
| PU | polyurethane(s) |
| PUNC | polyurethane nanocomposite(s) |
| rCD | reduced carbon dot |
| rGO | reduced graphene oxide |
| rpm | rotations per minute |
| *S. aureus* | *Staphylococcus aureus* |
| SAED | selected area electron diffraction |
| SEM | scanning electron microscopy |
| SHP | self healing polymer(s) |
| SCP | self cleaning polymer(s) |
| SFE | surface free energy |
| SME | shape memory effect |
| SMP | shape memory polymer(s) |
| SO | sunflower oil |
| SPR | surface plasmon resonance |
| SWCNT | single-walled carbon nanotube(s) |
| TBD | 1,5,7-Triazabicyclo[4.4.0]dec-5-ene |
| TBHP | *tert*-butyl hydroperoxide |
| TDI | toluene diisocyanate |
| TEM | transmission electron microscopy |
| TEMPO | 2,2,6,6-Tetramethylpiperidin-1-yl)oxyl |
| TGA | thermogravimetric analysis |
| THF | tetrahydrofuran |
| $T_g$ | glass transition temperature |
| $T_m$ | melting temperature |
| TLC | thin layer chromatography |
| TMS | tetramethylsilane |

| | |
|---|---|
| TOF | turnover frequency |
| TON | turnover number |
| TPU | thermoplastic polyurethane |
| UTM | universal testing machine |
| UV-Vis | ultraviolet-visible |
| VB | valence band |
| vol | volume |
| W | Watt |
| WERSA | water extract of rice straw ash |
| wt | Weight |
| XDI | *m*-Xylylene diisocyanate |
| XPS | X-ray photoelectron spectroscopy |
| XRD | X-ray diffraction |
| δ ppm | chemical shift in parts per million |
| µL | micro litre(s) |
| µm | micro meter(s) |

# *LIST OF SCHEMES*

# *LIST OF FIGURES*

# *LIST OF TABLES*