

# Subject Index

## A

- Activation energy
  - thermogravimetric analysis, 107
- Algorithms
  - for computer programs, 119–21
- ASTM
  - Committee E–5,
    - fire standards, 1–6
  - role in fire modeling, 1–6
  - Subcommittee E5.39
    - smoke and combustion products, 4
  - Subcommittee E5.39
    - fire modeling, 3–5
    - task groups, 3–5
- ASTM Standards
  - C 177–76: 107
  - E 84: 83, 87
  - E 176: 84
  - E 662: 36, 83, 85, 89–92
  - E 906–83: 9, 83, 87

## B

- Barriers
  - and fire containment, 66–67
- Benchmark Compartment Fire Model (BCFM) computer code, 116–26
- Building codes, 1,
  - industrial, 58–67
- Building materials
  - combustion of, ASTM Standard E 84:83, 87

## C

- Catalytic converters *See* PYROCAT
- Cellulose
  - combustion of, 106, 108–14
- Cement block
  - effect on hydrogen chloride gas, 42, 46

- Characteristic time
  - equations for, 69–71, 77, 79–80
  - fire
    - in force-ventilation enclosure, 77, 79–80
    - in sprinkler head link, 70–71
- Ceiling tile
  - effect on hydrogen chloride gas, 42–52
- Char
  - heat release rates, 15–16
- Codes, building *See* Building codes
- Combustion, heat of
  - poly(methyl methacrylate), 24–25, 95–97
  - wood, 105, 108–10, 113
- Compartment fires
  - computer codes for, 21–33, 116–26
  - definition of model, 119
  - early stages model, 21–33
  - energy and species balance, equations, 71–76
  - force-ventilated, 68–82, 71(illus)
  - hydrogen chloride gas generation/decay, 37–55
    - equations, 39–41
  - involved vs adjacent spaces, 118
  - zone type, 116–26
- Computer codes/programs
  - BCFM, 116–26
  - compartment fires, 21–22, 33, 116–27
  - fire modeling,
    - algorithm development, 119–21
    - anticipated uses for, 122–23
    - components of, 122
    - requirements for, 117–22
    - review of, 116–17
    - user interface, 121–22
    - user manual, 121–22
  - industrial fires, 58–67
  - smoke toxicity, 4
  - UNIFIRE, 58–67
  - wood fire, 105–15

Concrete walls  
 in compartment fire model, 71, 77  
 Conduction, heat loss of  
 equations for, 23–24  
 Cone calorimeter, 83, 88–103, 90(illus)  
 measurement of combustion,  
 poly(methyl methacrylate), 95–97  
 red oak, 95–97  
 upholstered furniture, 97–101  
 Corridor  
 decay of hydrogen chloride gas in, 53–56  
 Critical path method  
 fire risk analysis, 62–67

## D

Data bases  
 development of, 4  
 hazard analysis, 4  
 Documentation  
 fire models, 5

## E

Enclosure fires *See* Compartment fires  
 Energy and species balance  
 compartment fire model, equations, 71–76  
 Energy release rate  
 compartment fire model, equation, 24  
 Evolved gas analysis  
 for measuring heat of combustion, 107

## F

Fire modeling  
 ASTM standards for, 1–6 *See also* ASTM  
 Standards  
 classification of models, 3–4  
 compartment fires, 21–33, 105–15  
 “benchmark” compartment fire, 116–27  
 description of, 1–3  
 documentation of, 5  
 field models, 2  
 force-ventilation enclosure fire, 68–82,  
 71(illus)  
 heat/smoke release rate model, 7–20  
 hydrogen chloride gas generation/decay,  
 35–57  
 industrial buildings, 58–67  
 limitations of, 4  
 measurement methods, 1–6  
 pre-flashover, 66  
 room fires, 105–15  
 standards for, 116–27

validation rules, 4–5  
 wood fires, 105–15  
 zone models, 2, 36–56, 116–27  
 Fire risk analysis  
 ASTM Committee E–5: 59  
 prediction of, 58–67  
 Fire safety, 62–64, 67  
 Flame region, 84  
 Flame spread  
 poly(methyl methacrylate), equation, 23  
 Flame travel rate (FTR), 8–10  
 Flashover, 22, 29–32  
 pre-flashover fire, 66  
 Flux, self-propagating (SPF), 10–20  
 Flux-time product (FTP), 8–20,  
 12–13(tables)  
 equations, 10, 13, 14  
 Force-ventilation, 68, 76–81  
 Furniture, upholstered  
 combustion of, 97–101

## G

Gas analysis  
 cellulose combustion, 107–10  
 force-ventilation fire, 75–81, 80(table)  
 gas-surface equilibrium, 40  
 hydrogen chloride gas generation/decay,  
 35–57  
 wood combustion, 107–10  
 equations, 108  
 Gravimetric soot sampler, 92–93  
 Gypsum board  
 effect on hydrogen chloride gas, 42–52

## H

Hazard evaluation  
 data base for, 4  
 force-ventilation enclosure fire, 68–81  
 Heat of combustion *See* Combustion, heat  
 of  
 Heat/mass transfer  
 compartment fire model, equations for,  
 23–30, 32  
 Heat release rate  
 ASTM Standards  
 E 662: 83  
 E 906–83: 9–10  
 cellulose, 108–14  
 force-ventilation compartment fire,  
 76(table)  
 equations for, 74  
 model for, 7–20,  
 equations, 12–15

particle board, equations, 12–15  
 poly(methyl methacrylate), equations, 25  
 wood, 106–14  
 Humidity  
   effect on hydrogen chloride gas, 38–55  
 Hydrogen chloride gas  
   decay of, 36, 37  
     equation, 41  
   in fire scenarios, 35–57  
   gas-surface equilibrium, 38(illus)  
     equation, 40  
   generation of 36, 38  
     equation, 39  
   transport of, 36  
     equation, 39–40  
   water saturation, equation, 40

## I

Ignition, 10, 12, 13  
   probability of, 60–62  
 Industrial buildings  
   predictive fire model, 58–67  
 Insurance  
   and fire risk analysis, 58–60

## L

Laser extinction beam  
   in cone calorimetry, 90–92, 90(illus)

## M

Marinite  
   effect on hydrogen chloride gas, 43–47  
 Mass loss rate  
   cellulose combustion, 113–14  
   force-ventilation compartment fire,  
     76(table)  
 Mass transfer, hydrogen chloride gas equa-  
   tion, 39  
 Materials/products  
   ASTM Standard E 84: 83, 87  
   prediction of fire performance, 7–20  
 Mathematical models *See also* Fire modeling  
   fire in industrial buildings, 64–67  
   release rate tests, 7–20  
 Methane burner fires, 77–81  
 Microbalance  
   for soot sampling, 93–95  
 Model validation, 1–6

## N

NBS Smoke Chamber, 87–88

## P

Particle board  
   heat and smoke release rate, 12–18  
 Plenum  
   hydrogen chloride gas decay in, 52–53  
 Plume  
   in mathematical modeling, 8, 66–67  
 PMMA *See* Poly(methyl methacrylate)  
 Poly(methyl methacrylate)  
   combustion of, 22–23, 87–97, 97(table)  
     cone calorimeter measurement, 95–97  
     NBS smoke chamber measurement,  
       87–88, 89  
   effect on hydrogen chloride gas, 42–52  
   soot production, 96–97  
 Poly(vinyl chloride)  
   combustion of, 35–57  
 PYROCAT (pyrolyzer and catalytic con-  
   verter)  
   diagram of, 109  
   for measuring heat of combustion, 108–10

## R

Rate of heat release (RHR) *See* Heat release  
   rate  
 Red oak  
   combustion of, 95–97  
 Release (heat and smoke) rate *See also* Heat  
   release rate; Smoke, release rate  
   conceptual model, 7–9  
   tests, 9–20  
     ASTM Standard E 906–83: 9  
 Risk analysis *See* Fire risk analysis  
 Room fires *See* Compartment fires

## S

Sample, test *See* Specimen  
 Smoke  
   ASTM Subcommittee E5.21, 4  
   bench-scale measurement, ASTM Stand-  
     ard E 906–83: 87  
   definition of, ASTM Standard E 176:84  
   in fire models, 2, 86–103  
   from hydrogen chloride decay, 36  
   light extinction beam measurements,  
     equations, 84–86  
     equipment, 89–92  
   optical properties of, 84–86  
     ASTM Standard E 662: 83, 85, 89–92  
   release rate, 9, 19, 83, 87  
 Soot  
   definition of, 84

Soot—(*Continued*)

- measurement of, 85, 86
  - gravimetric soot sampler, 92–93, 91(illus)
  - tapered-element oscillating microbalance, 93–95, 93(illus)
- poly(methyl methacrylate) combustion, 94(table)
- red oak combustion, 94(table)
- upholstered furniture combustion, 100(table)

## Specimen

- selection, 11–12
- size, and heat/smoke release rate values, 17–18

Standards, fire test methods *See also* ASTM Standards

- ASTM Committee, E-5: 1–6
- in compartment fires, 116–27

## Surface area

- and decay rate of hydrogen chloride gas, 41
- and heat release rate, 17–18
- mass transfer of hydrogen chloride gas, 35–57, 38(illus)

**T**

- Tapered-element oscillatory microbalance (TEOM), 93–95
- Thermal conductivity
  - ASTM Standard C 177–76:107
  - poly(methyl methacrylate), equation, 23
  - wood char, 106–07
- Thermogravimetric analysis
  - forest fuels, 107

**U**

- Unified fire behavior prediction model (UNIFIRE), 58–67
- Upholstered furniture
  - combustion of, 97–101

**W**

- Wood
  - combustion of, 105–14

**V**

- Ventilation
  - and fire growth, 21–33