Subject Index

A

AA7072 clad AA3003 alloy, 83
Acute Lethal Dose (LD50), PG antifreeze and SCAs, 149
Alkalinity, reserve
depletion by glycol degradation, 234
oxalic acid cleaning effects, 190
test strips for, 165
in used coolant, statistical analysis, 234
Aluminum
corrosion protection of heat transfer surfaces, 11
protection with phosphate-molybdate SCAs, 128
radiators, sebacic acid coolant effects, 63
Aluminum alloys
carboxylic-acid corrosion inhibitors, 44
radiators, corrosion testing, 83
Antifreeze, see Coolant/antifreeze formulations
ASTM standards
D 1121: 234
D 1287: 234
D 1384: 11, 44, 63, 83, 128, 248, 276
D 2272: 258
D 2570: 248, 276
D 2809: 44, 276
D 2847: 63, 190
D 3306: 25, 44, 128, 190, 276
D 4340: 11, 25, 44, 63, 248, 276
D 4985: 25, 289
G 85: 83
standards under development, 289
Automotive radiators, see Radiators

B

Bench tests, for comparative coolant studies, 25
Biodegradability, ethylene and propylene glycols, 149
Borate conditioning, 190

C

Calcium-iron-phosphate complexes on seal faces, 205
Carboxylic acid
cooling formulation, 25
corrosion inhibitors, 44
Cavitation corrosion
cylinder liners, 165
diesel cylinder liners, 107
heavy duty engines, 289
history of, 6
phosphate-molybdate SCAs for diesel engines, 128
theories of, 107
Centrifugation, of coolants, 276
CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), 149
Chloride, test strips for, 165
Clean Air Act Amendment of 1990, 149
Closed-loop coolant flushing system, 248
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 149
Contaminants
in engine coolants, 149
removal with multi-stage purification process, 258
Coolant/antifreeze formulations
carboxylic acid corrosion inhibitors in, 44
comparative, fleet test of, 25
heavy duty, 248, 289
ICP and LA-ICP applications, 180
LD50 of PG antifreeze and SCAs, 149
life extension of, 248, 276
light duty, 248
SCA effects, 128
and sealing performance, 215
silicate-based, 44
test methods, 289
Coolant pumps, see also Water pumps
bench test for, 25
failure, fleet tests, 25
Coolant toxicity, see Toxicity
Cooling systems
design history, 6
oxalic acid cleaning, 190
Copper, deposition on sealing surfaces, 215
Corrosion inhibitors
carboxylic acid, 25, 44
and coolant life extension, 248
coolant recycling processes evaluation, 276
history of requirements for, 6
oxalic acid cleaning effects, 190
phosphate-molybdate SCAs, 128
removal with multi-stage purification process, 258
and seal performance, 215
sebacic acid extended life coolant, 63
traditional, pump failure and, 25
in used coolant, statistical analysis, 234
Corrosion protection, aluminum surfaces, 11
Corrosion testing, radiators
aluminum alloys, 83
electrochemical methods for, 83
Cylinder heads, design history, 6
Cylinder liners cavitation protection
diesel engines, 107
pitting, 107
test strips for, 165

D
1,10-Decanedioic combination coolants, 44
Degradation acids, in used coolant, 234
Deionization, of coolants, 276
Depletion rates, sebacic acid and silicate phosphate coolants, 63
Diacids, monoacid/diacid inhibitors, 11
Dibenzothiazyl disulfide deposition, 215
Diesel engines
coolant technology update, 289
cylinder liners, cavitation corrosion, 107, 128, 289
phosphate-molybdate SCAs, 128
water pump seal deposits, 205
Diethylene glycol, in used coolant, statistical analysis, 234
Disposal, coolants and additives, 149
Dual-bed deionization-based multi-stage coolant purification, 258
Dynamometer test method, 6

E
Electrochemical corrosion testing, radiator materials, 83
Electronic spectroscopy for chemical analysis, comparison with LA-ICP sample analysis, 180
Environmental concerns, toxicity and disposal of coolants, 149
Environmental Protection Agency, hazardous waste characterization guidelines, 234
EP Tox (extraction procedure toxicity test), 234
Ethylene glycol
biodegradability, 149
toxicity and disposal, 149
in used coolant, statistical analysis, 234
Ethylene glycol coolants, history of, 6
2-Ethylhexanoic acid coolants, 44
Extended life coolants
disposal, 149
sebacic acid inhibitor technology, 63
Extraction procedure toxicity test (EP Tox), 234

F
Face deposits, water pump, 205
Ferrous oxalate, formation chemistry, 190
Filling, of coolants, 248
Filtration, of coolants, 248, 276
Filtration-flocculation-coagulation, of coolants, 276
Fleet tests
carboxylic acid coolants, 44
coolant pump failure, 25
oxalic acid cleaning carryover effects, 190
sebacic acid coolants, 63
silicate phosphate coolants, 63
Flushing, of coolants, 248
Fourier transform infrared spectrometry, protective films, 11
Freezepoint, test strips for, 165
FTIR, see Fourier transform infrared spectrometry
FVV Test (German), 128

G
Gas chromatography, carboxylic-acid corrosion inhibitors, 4
German FVV Test, 128
GM 1825M coolants, 276
GM 6038M coolants, 25, 149
GM 6043M coolants, 44
H

Hard water, effects on pump seals, 205
Hazardous waste
determination in used coolant, 234
EPA characterization guidelines, 234
management, 149
in multi-stage purified coolant, 258
Heater cores, sebacic acid coolant effects, 63
Heat-exchange surfaces
aluminum, corrosion protection, 11
scaling, 289
Heavy duty diesel engines, see Diesel engines
Heavy metals
removal with multi-stage purification process, 258
in used coolant, statistical analysis, 234
High lead solder alloys, carboxylic-acid corrosion inhibitors, 44

I

ICP, see Inductively coupled plasma emission spectroscopy
Inductively coupled plasma emission spectroscopy
carboxylic-acid corrosion inhibitors, 44
for coolant systems, 180
Inhibitor depletion
high silicate alkaline phosphate coolant, 63
sebacic acid coolant, 63
Ion chromatography, carboxylic-acid corrosion inhibitors, 44
Ion exchange, multi-stage coolant purification using, 258
Iron
deposition on sealing surfaces, 215
effects on water pump seals, 205
Iron oxalate, formation chemistry, 190

K

K805 cladding, 83

L

LA-ICP, see Laser ablation inductively coupled plasma emission spectroscopy
Laser ablation inductively coupled plasma emission spectroscopy, 180
Lead
in multi-stage purified coolant, 258
in used coolant, statistical analysis, 234
Lead solder alloys, carboxylic-acid corrosion inhibitors, 44
Lethal dose 50, PG antifreeze and SCAs, 149
Life extension, of coolants, 248, 276
Light duty vehicles, coolant life extension, 248
Liner pitting
of diesel cylinders, 107, 128
heavy duty engines, 289
test strips for, 165
Long life coolants
carboxylic acid, 25
disposal, 149
and seal performance, 215

M

Maintenance, of coolants, 248, 289
Mercaptobenzothiazole, test strips for, 165
Microscopy, protective films, 11
Monoacid/diacid inhibitors, 11
Multi-stage process, for coolant purification, 258

O

Octanoic acid coolants, 44
Off-site coolant recycling, 276, 289
On-site analyses, test strips for, 165
On-site coolant recycling, 276
Oxalic acid cleaning, chemistry of, 190
Oxygen, and inhibitor solidification, 215

P

PG antifreeze, LD_{50}, 149
pH
oxalic acid cleaning effects, 190
test strips for, 165
in used coolant, statistical analysis, 234
Phosphate-molybdate SCAs, for diesel engines, 128
Phosphorus, deposition on sealing surfaces, 215
POTWs (publicly owned waste treatment works), 149
Propylene glycol
biodegradability, 149
toxicity and disposal, 149
in used coolant, statistical analysis, 234
Protective films, analysis, microscopy and FTIR, 11
Publicly owned waste treatment works (POTWs), 149
R

Radiators
- aluminum, sebacic acid coolant effects, 63
- aluminum alloy, corrosion testing, 83
- deposits, ICP spectroscopy for, 180

Radiator solder corrosion, history of, 6

RCRA (Resource Conservation and Recovery Act), 149

Recycling
- coolant life extension and, 248
- multi-stage process with dual-bed deionization, 258
- off-site, 276, 289
- on-site, 276
- processes, evaluation, 276
- regulations for coolants, 149
- technology update, 289

Regulatory issues, coolant toxicity and disposal, 149

Reserve alkalinity
- depletion by glycol degradation, 234
- oxalic acid cleaning effects, 190
- test strips for, 165
- in used coolant, statistical analysis, 234

Resource Conservation and Recovery Act (RCRA), 149

Reverse osmosis recycling processes, 276

“Right to Know” laws, Federal, 149

S

Scaling
- heat transfer surfaces, 289

Scanning auger microprobe/energy dispersive X-ray, comparison with LA-ICP sample analysis, 180

Scanning electron microscopy/energy dispersive x-ray, comparison with LA-ICP sample analysis, 180

SCAs, see Supplement coolant additives

Sebacic acid coolants, 63

Silicate-based coolants, 44

Silicate deposits, high-temperature-related, 215

Silicate gelation, phosphate-molybdate SCA effects, 128

Silicate phosphate coolants
- depletion rates, 63
- fleet tests, 63

Sodium tolyltriazole coolants, 44

Solder bloom
- in heavy duty engines, 289
- phosphate-molybdate SCA effects, 128

Solidified silicates, 215

Statistical analyses, used coolant characterization, 234

Superfund Amendment Reauthorization Act Title III, 258

Supplement coolant additives
- coolant life extension with, 248
- in diesel engines, 107, 128
- LD₉₀ data, 149
- overtreatment effects, 107
- phosphate-molybdate, 128

SWAAT test, method G43, 83

T

Test strips, for on-site analyses, 165

Tolyltriazole coolants, 44

Toxicity
- borate-nitrate SCAs, 128
- coolants and additives, 149
- phosphate-molybdate SCAs, 128

V

Vacuum distillation recycling processes, 276

W

Water pumps, see also Coolant pumps
- failure
  - coolant composition and, 215
  - fleet tests, 25
- leakage, phosphate-molybdate SCA effects, 128
- seals
  - and coolant composition, 215
  - deposit compositions, 205
  - in heavy duty applications, 289
  - LA-ICP for, 180
- Wavelength dispersive spectroscopy, pump face seal deposits, 205