EE-527: MicroFabrication

Chemical Storage and Labeling
## Chemical Precaution Codes

<table>
<thead>
<tr>
<th>A</th>
<th>Acid</th>
<th>N</th>
<th>Narcotic</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Base</td>
<td>O</td>
<td>Oxidizer</td>
</tr>
<tr>
<td>C</td>
<td>Corrosive</td>
<td>P</td>
<td>Pyrophoric</td>
</tr>
<tr>
<td>D</td>
<td>Dizziness &amp; Drowsiness</td>
<td>Q</td>
<td>Heat Sensitive</td>
</tr>
<tr>
<td>E</td>
<td>Explosive</td>
<td>R</td>
<td>Radioactive</td>
</tr>
<tr>
<td>F</td>
<td>Flammable</td>
<td>S</td>
<td>Solid</td>
</tr>
<tr>
<td>G</td>
<td>Compressed Gas</td>
<td>T</td>
<td>Toxic</td>
</tr>
<tr>
<td>H</td>
<td>Hygroscopic</td>
<td>U</td>
<td>Ultrahigh Purity</td>
</tr>
<tr>
<td>I</td>
<td>Irritant</td>
<td>V</td>
<td>Contents under Vacuum</td>
</tr>
<tr>
<td>J</td>
<td>Etiological Agent</td>
<td>W</td>
<td>Water Reactive</td>
</tr>
<tr>
<td>K</td>
<td>Carcinogenic</td>
<td>X</td>
<td>Asphyxiant</td>
</tr>
<tr>
<td>L</td>
<td>Liquid</td>
<td>Y</td>
<td>Vibration Sensitive</td>
</tr>
<tr>
<td>M</td>
<td>Light Sensitive</td>
<td>Z</td>
<td>Static Sensitive</td>
</tr>
</tbody>
</table>

R. B. Darling / EE-527
Chemical Grades and Purity - 1

• Commercial or Technical Grade
  – typically 85-90 % purity
  – rarely used in the laboratory

• Practical Grade
  – small step above technical grade
  – often contain intermediate compounds as part of the preparation process

• United States Pharmacopoeia (USP) Grade
  – suitable for drug use
  – generally acceptable for chemistry lab work

• Chemically Pure (CP) Grade
  – almost as pure as reagent grade, but application determines whether purity is adequate for the purpose
Chemical Grades and Purity - 2

• **Spectroscopic Grade**
  – purity determined by optical absorption at particular wavelengths
  – usually around 99 % purity
  – used for IR, VIS, & UV spectrophotometry

• **Chromatography Grade**
  – minimum of 99 % purity with no single impurity over 0.2 %

• **Reagent Analyzed or Reagent Grade**
  – certified to have impurities below specific levels set by the Committee on Analytical Reagents of the American Chemical Society (ACS)
  – bottles are identified by a batch number
  – minimum standard for any chemical analysis work
Chemical Grades and Purity - 3

• **Electronic or Semiconductor Grade**
  – specified to contain less than set levels of specific impurities:
    • Na, K, Ca, Mg, etc.
  – common subdivisions are:
    • Low-Sodium MOS Grade
    • Low-Sodium CMOS Grade

• **Primary Standard Grade**
  – at least 99.95 % purity
  – can serve as reference standards in analytical procedures

• **Ultra-High Purity Grade**
  – usually solids that have been successively refined
  – expressed as number of nines of purity, e.g. 5-9s = 99.999 % purity
  – highest possible purity of any material
Chemical Labeling

- **Primary Labeling**
  - printed on containers by the manufacturer
  - specific information is set by Federal Lab Safety Standard (FLSS)

- **Secondary Labeling**
  - used to label smaller, secondary containers
  - must be done by user to provide point-of-use information
  - must contain:
    - common or scientific name of chemical
    - name of person who is responsible for it
    - date at which container was filled
    - any specific precautions; minimum is NFPA 704M symbol
DOT/United Nations Hazard Classes

– Class-1 Explosives Class A, B, C
– Class-2 Compressed Gases Flammable, Nonflammable
– Class-3 Flammable Liquids
– Class-4 Flammable Solids
– Class-5 Oxidizing Materials Oxidizers, Organic Peroxides
– Class-6 Poisonous Materials Class A, B
– Irritating Materials Domestic, Import/Export
– Class-7 Radioactive Materials Class I, II, III
– Class-8 Corrosive Materials
– Class-9 Miscellaneous Hazards

• Each has standard international placards that must label any material for transportation
NFPA 704M Labeling System

• National Fire Protection Association (NFPA)
• Hazard Ratings; 0 to 4:
  – 0  none
  – 1  slight
  – 2  significant
  – 3  severe
  – 4  extreme
• Example: $\text{H}_2\text{SO}_4$:

Some manufacturers, e.g. Baker, use the fourth (white) position to indicate immediate contact hazard
Secondary Labeling Methods in the Lab

• Solvent wash bottles
  – Use the pre-labeled polypropylene squirt bottles and just refill then when needed.

• Glass beakers
  – For long term use in the same process, use a Sharpie felt marker on the white labeling area, or create a tape label and apply this to the beaker. Tape labels will resist most chemicals, solvents will dissolve the Sharpie felt tip marks.
  – For short term use, label a filter paper and place the beaker over top of it to identify it.

• Screw cap chemical bottles
  – Use a clean, new bottle and put a pressure sensitive label on it, or use tape labels.