Questions for Class 7 (May 13)

Devolatilization Measurements, Swelling

Chemical Engineering 733

- 1. Please discuss the merits of the following methods for conducting devolatilization experiments: (a) thermogravimetric analyzers, (b) heated grids, (c) drop tubes, (d) flat flame burners, and (e) laser-heating of suspended particles. You may have to postulate what these reactors do if they are unfamiliar.
- 2. The Lee Smith book states that particle temperature is important for determining devolatilization kinetics, and that this has generally been a problem (especially at high heating rates). Please discuss why this is so important yet so difficult to measure. You may want to refer to the two most common types of rapid devolatilization experiments: drop tube reactors and heated grid reactors.
- 3. On p. 225, Lee Smith alludes to the fact that increases in pressure lead to decreases in tar and total volatiles yields. This can also be seen in Figure 5.110. Please explain why this happens.
- 4. Tom Gale (<u>Comb. & Flame, 100, 94-100, 1995</u>) showed how swelling decreased as heating rate increased between 10,000 K/s and 100,000 K/s for swelling coals. Please explain why swelling (a) increases with heating rate up to ~10,000 K/s and (b) decreases with heating rate after 10,000 K/s.
- 5. Randy Shurtz (<u>Energy & Fuels, 25, 2163-2173, 2011</u>) modeled the Tom Gale data. Please explain how this model worked.
- 6. Please review the influence of the following variables on total volatiles and tar yield: (a) heating rate; (b) ambient pressure; (c) temperature; (d) coal rank; (e) particle size. Show the effect and give a brief explanation why each variable has the exhibited effect.