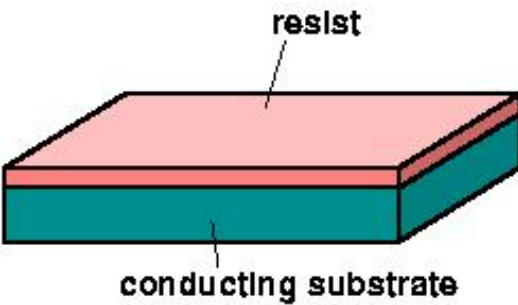


Optimal concentrations of Ethanol and Isopropanol for the dissolution of PMMA

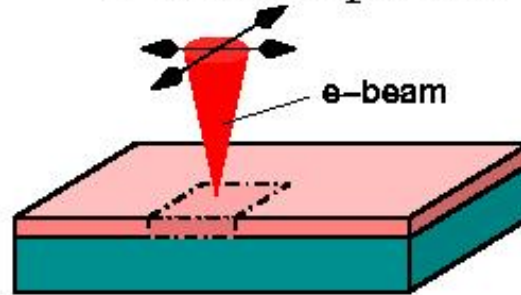
By Maya Costales

Background

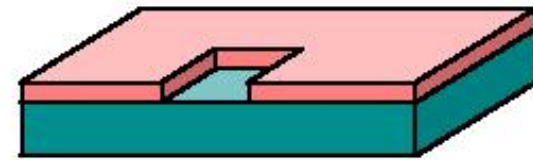
spin-coated sample



e-beam exposure



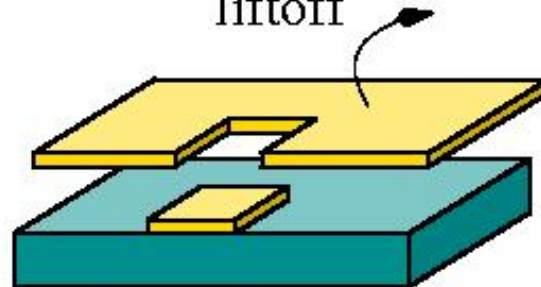
chem. development



metal deposition



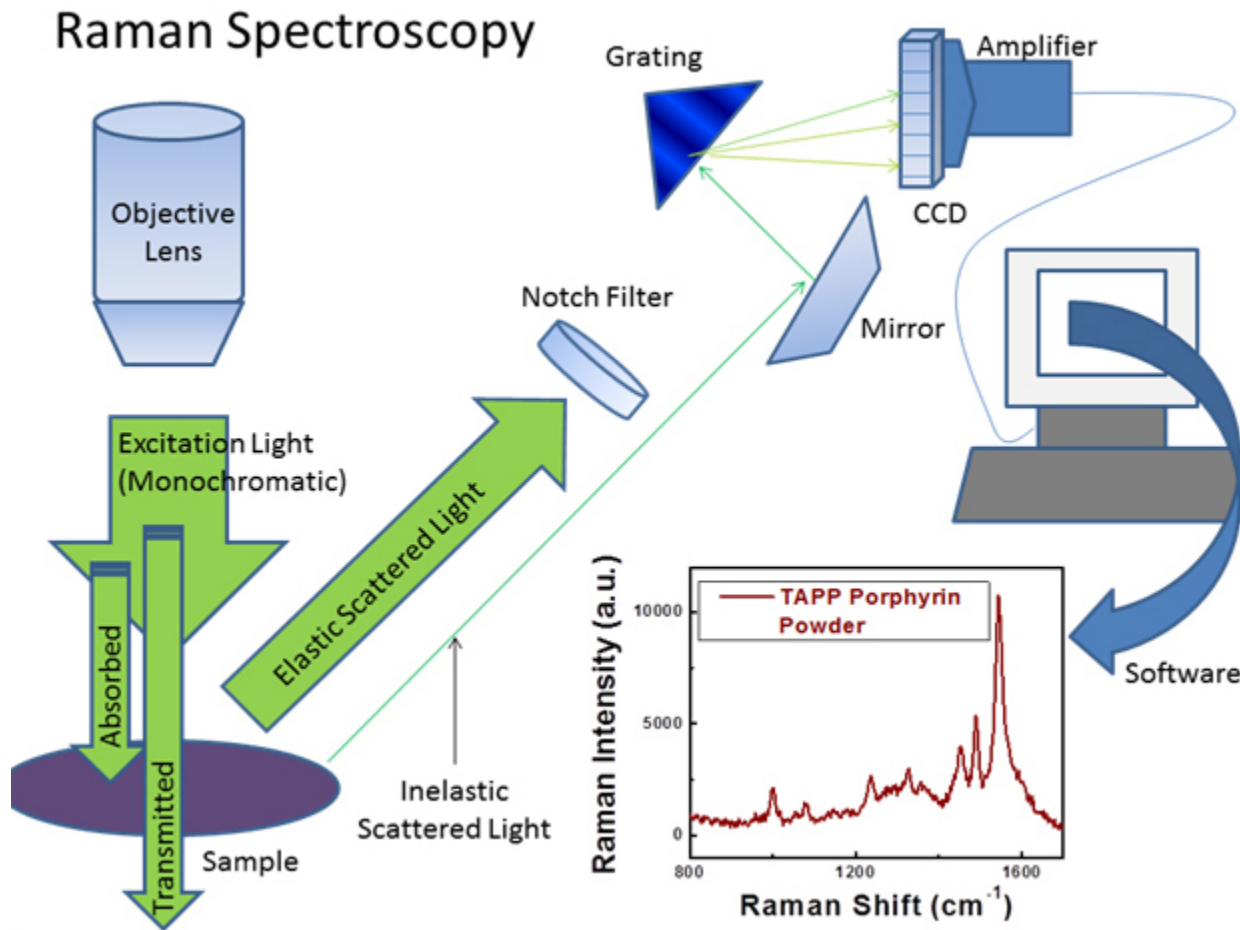
liftoff



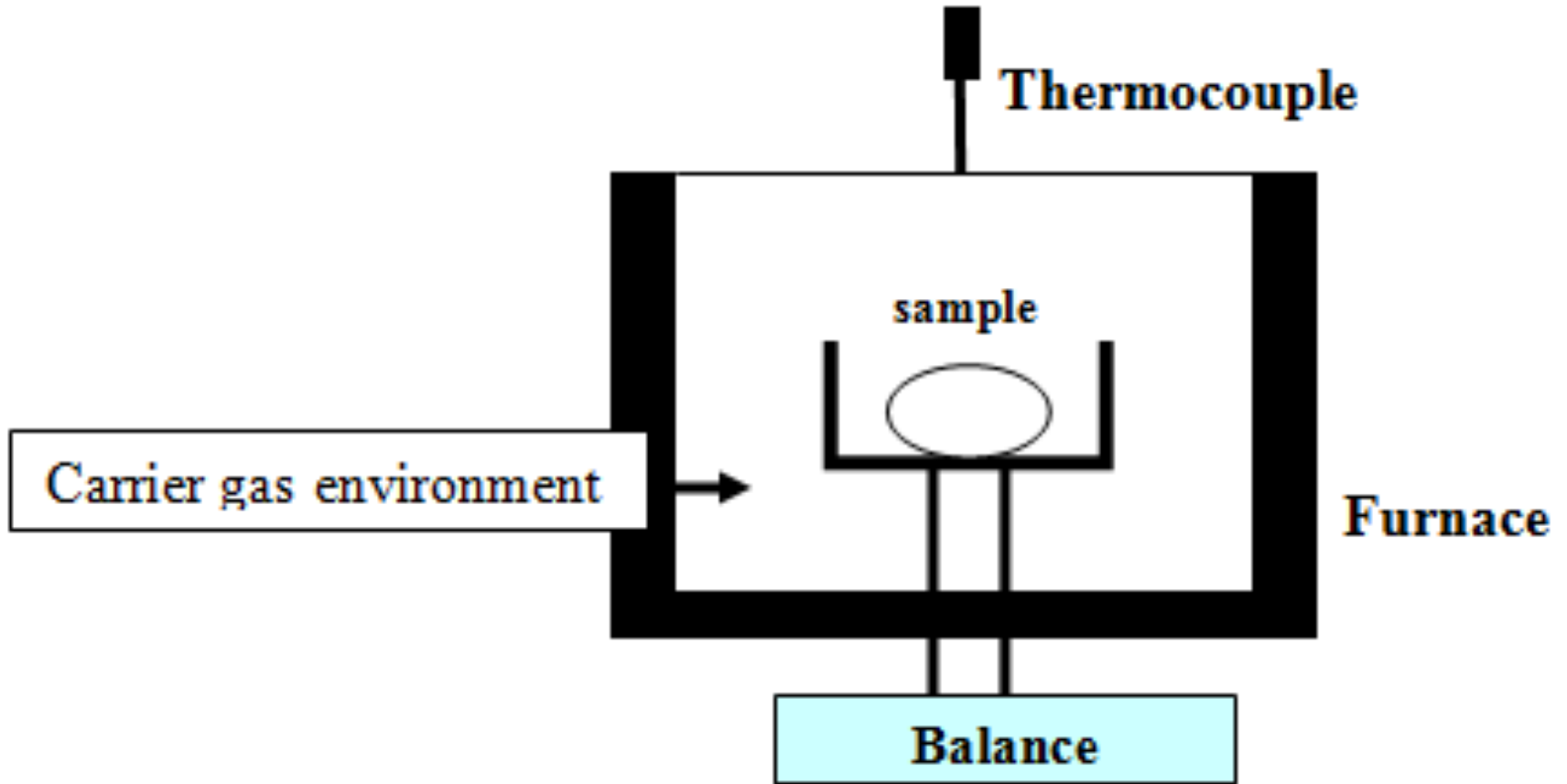
final structure



Raman Spectroscopy



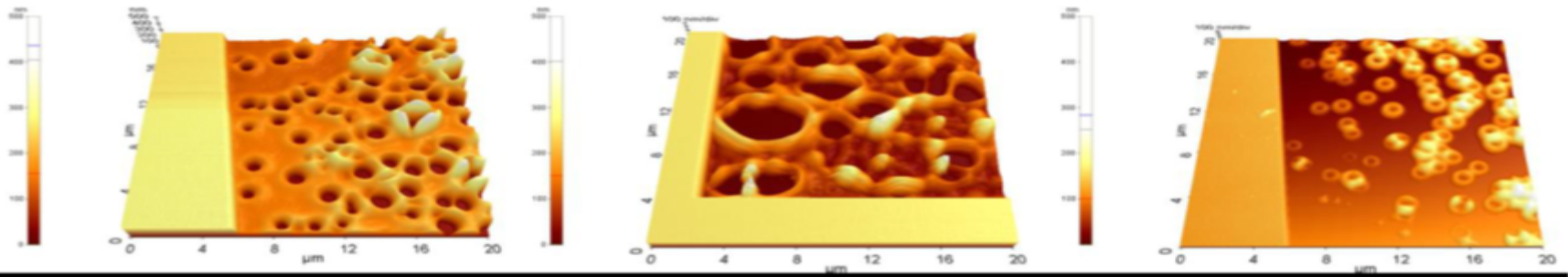
Thermogravimetric Analysis



Focusing Question Last Year

- Can Alcohol Water Solutions be used as replacements for MIBK-IPA solutions as PMMA developers?

Atomic Force Scans



Focusing Question

- Can we learn from Raman and TGA how PMMA and the alcohol-water mixtures interact?

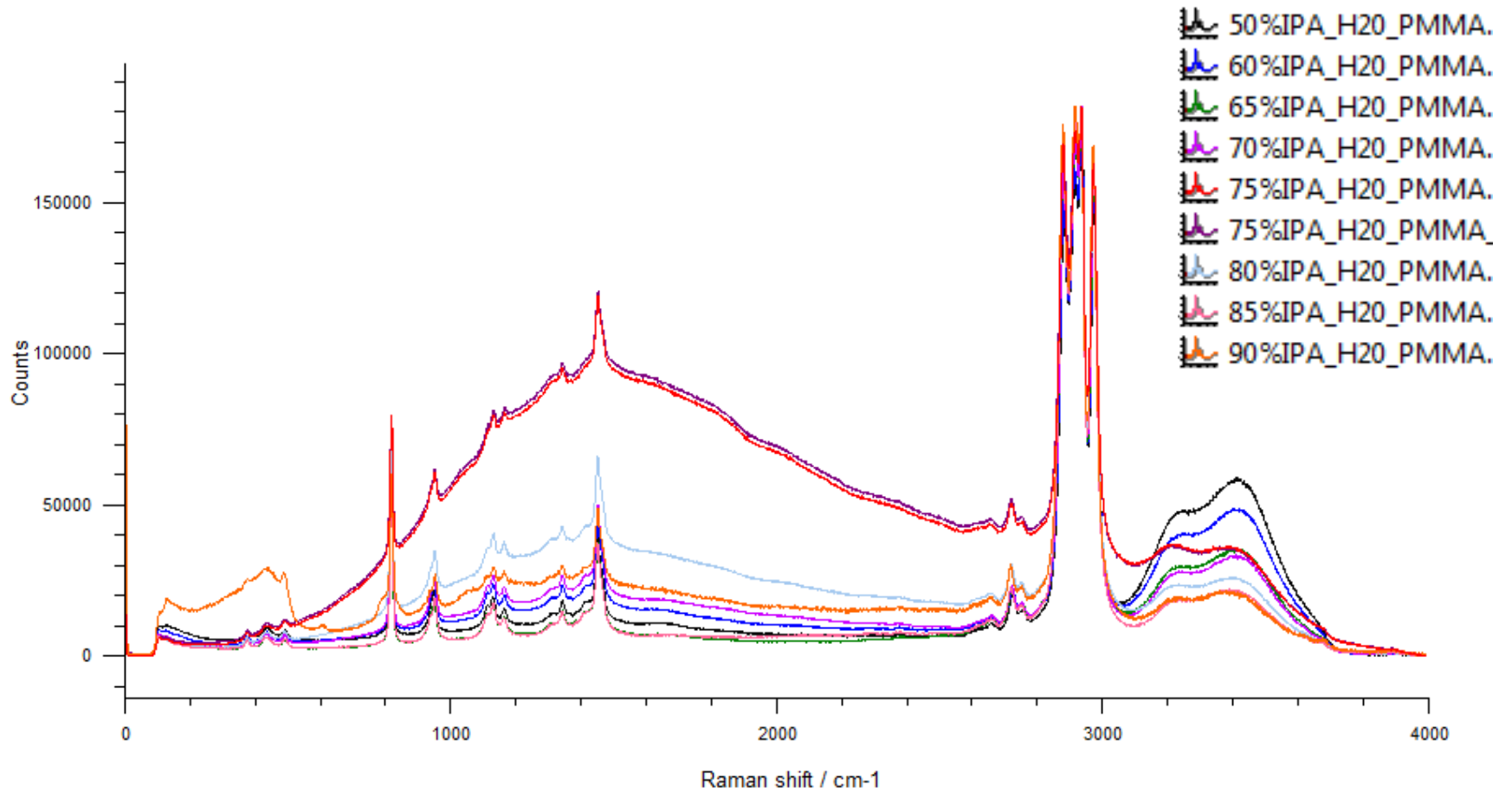
Data Acquisition Protocol/Methods

- Raman
- TGA

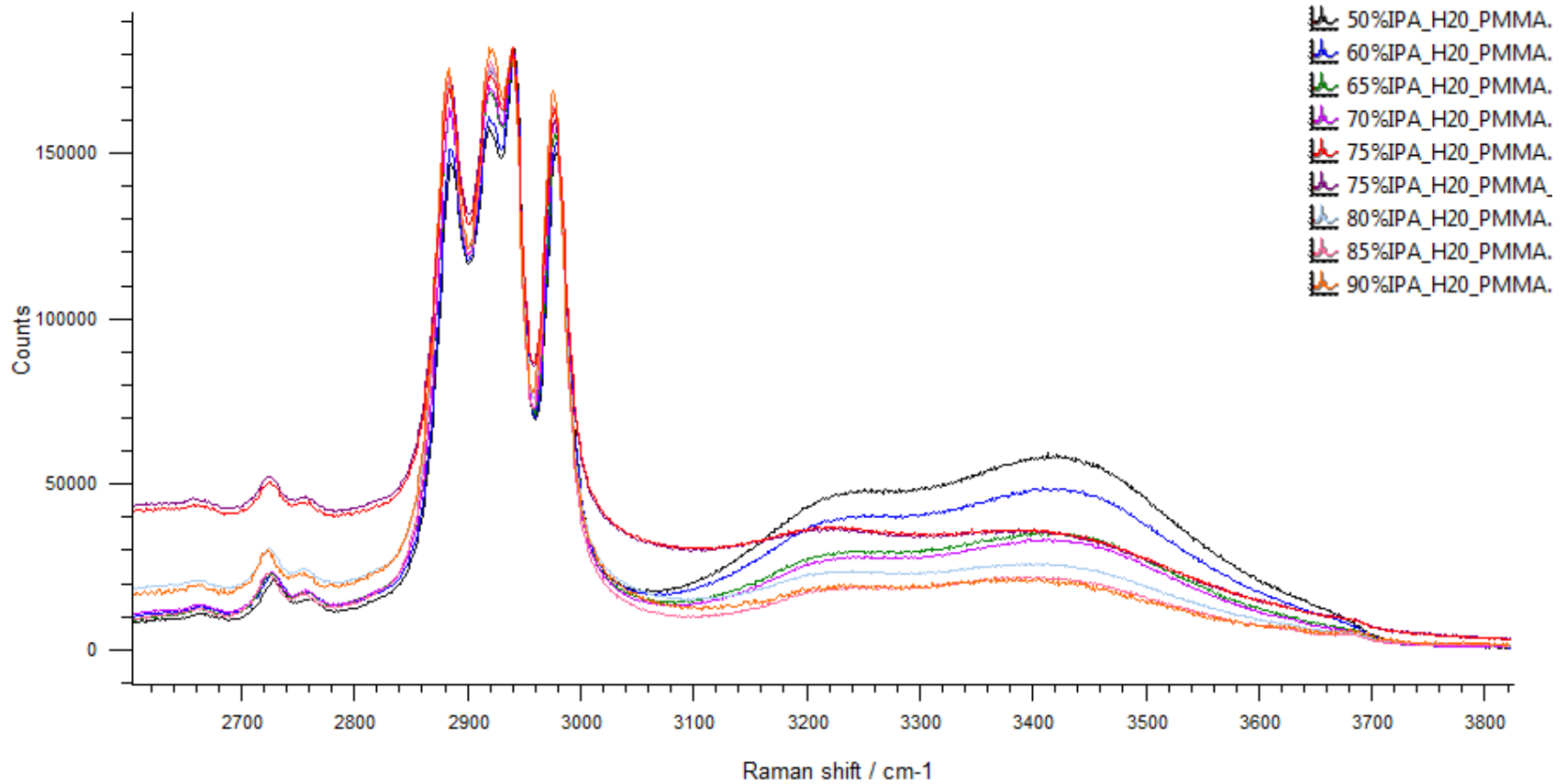
Issues with Data Acquisition

- Raman Laser
- TGA recipe
- Machine Artifacts
- Raman data acquisition and Fluorescence

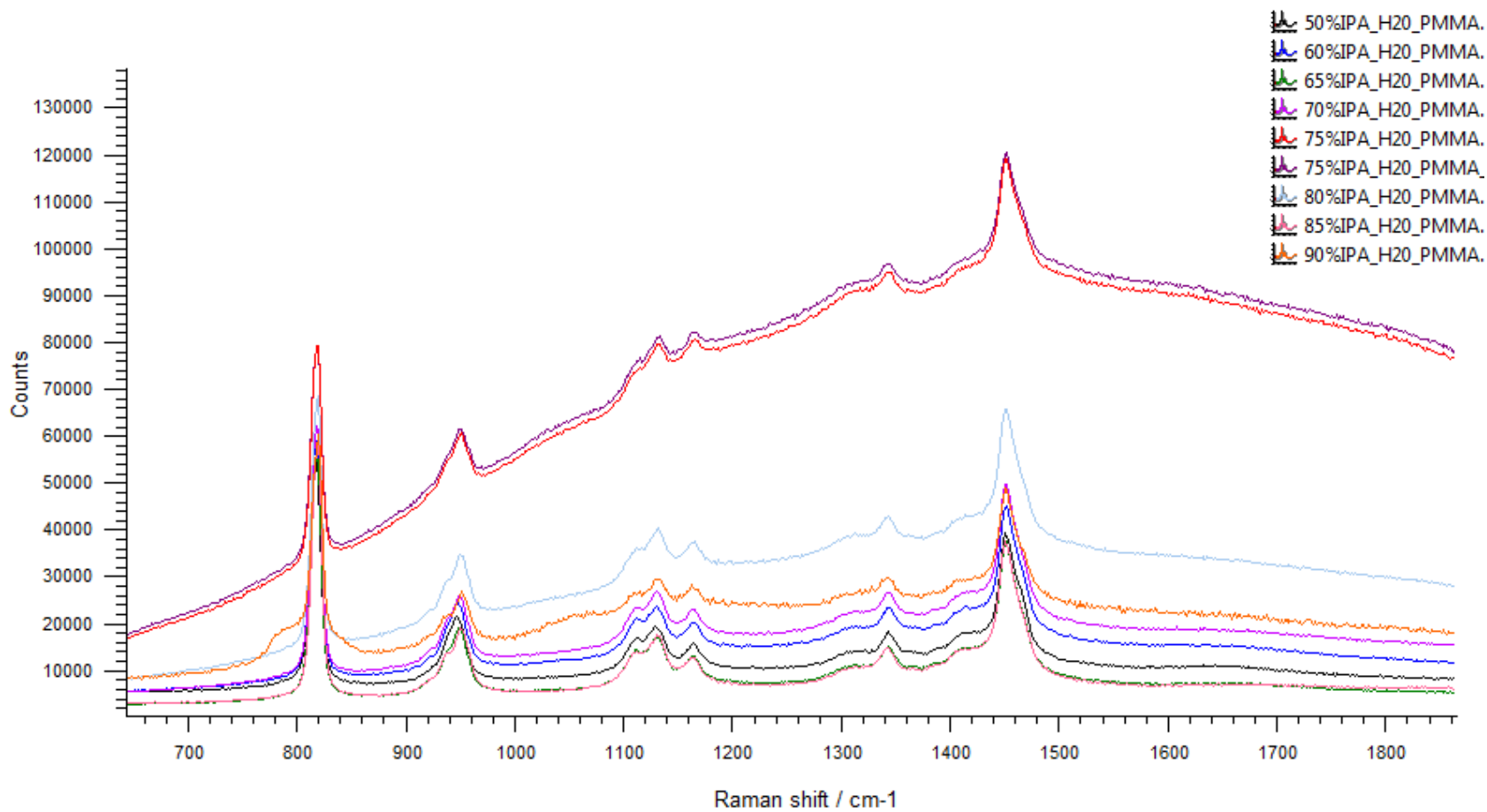
IPA-PMMA Raman Data



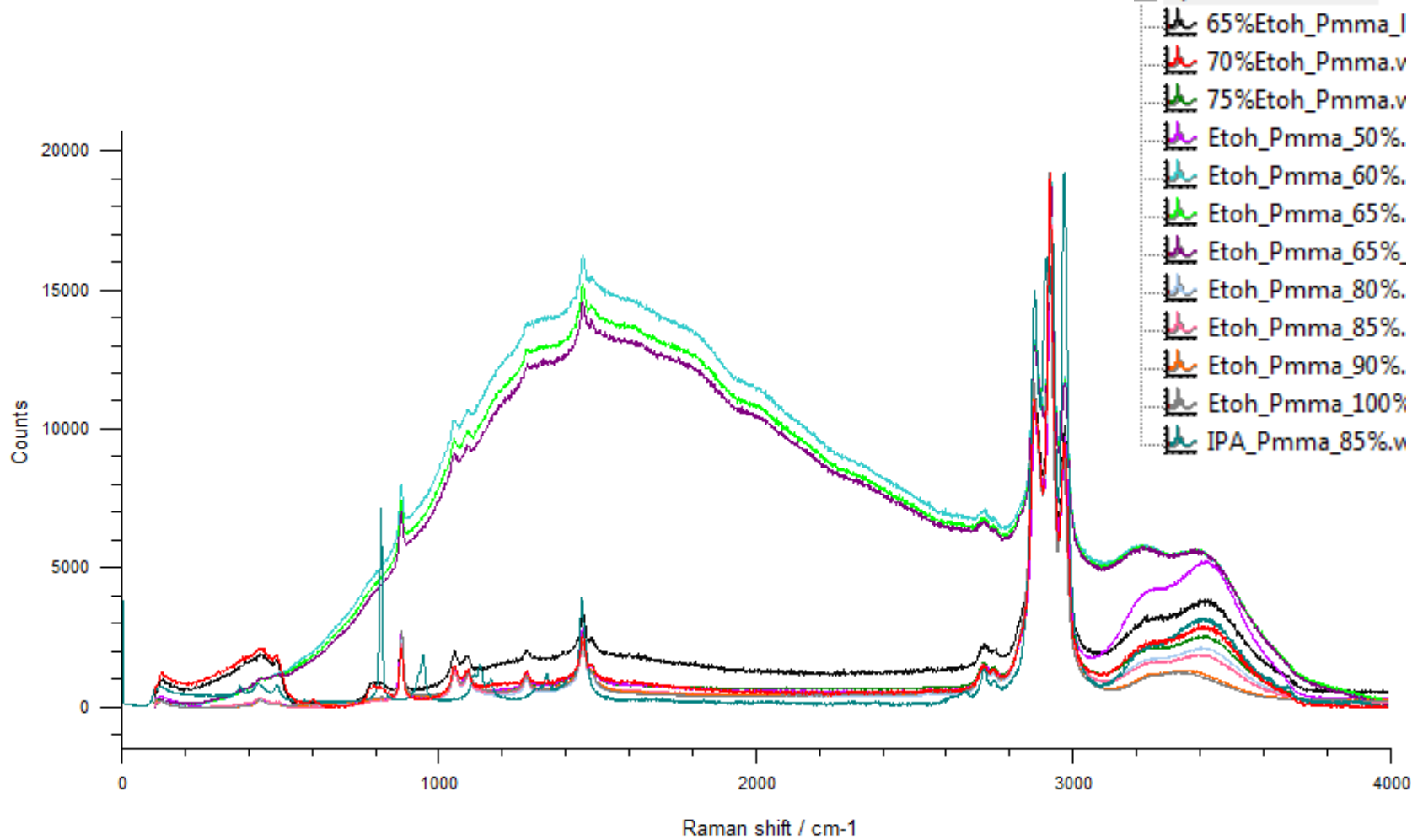
CH and OH stretching bands IPA



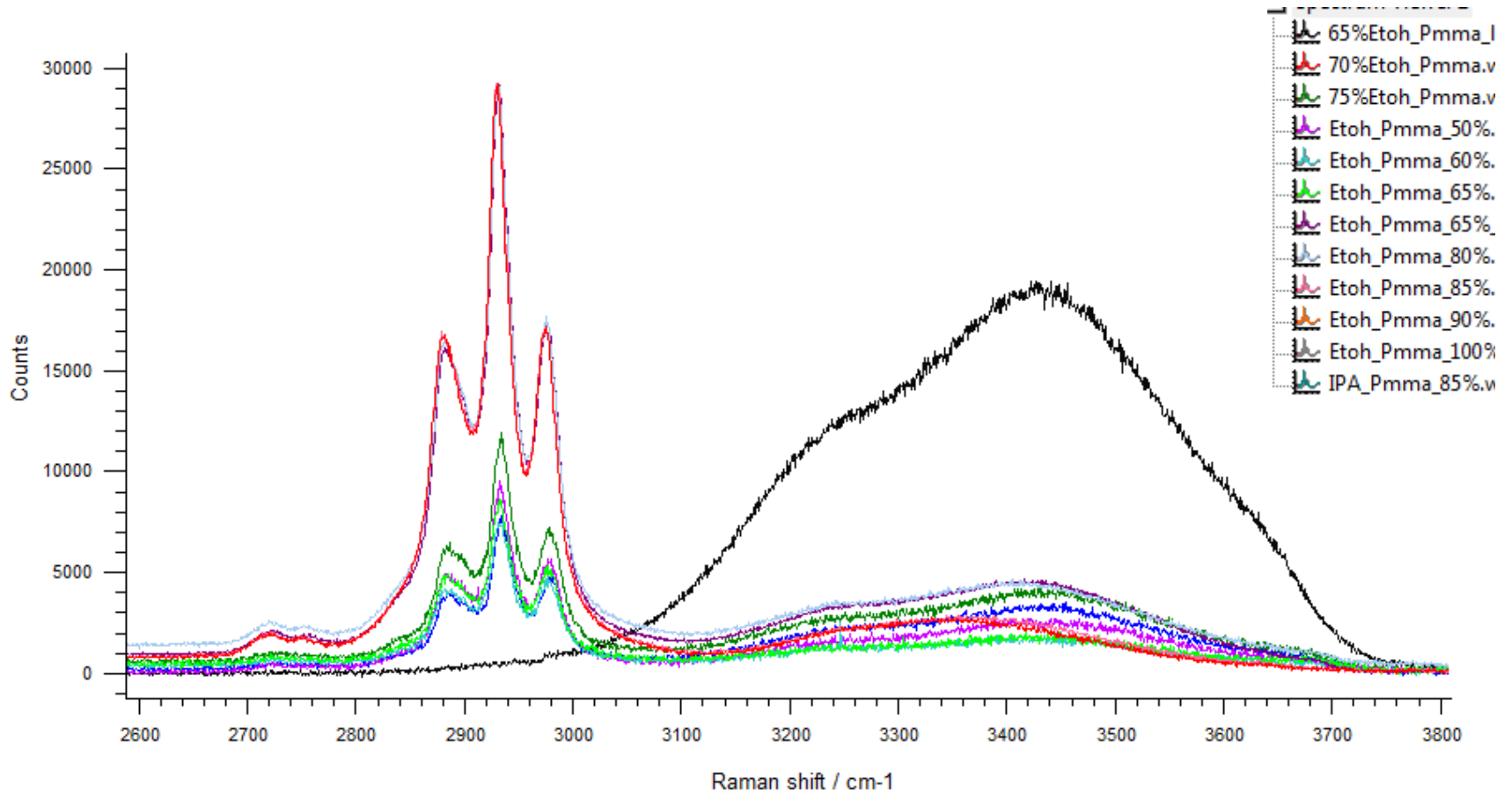
700-1800 IPA-PMMA



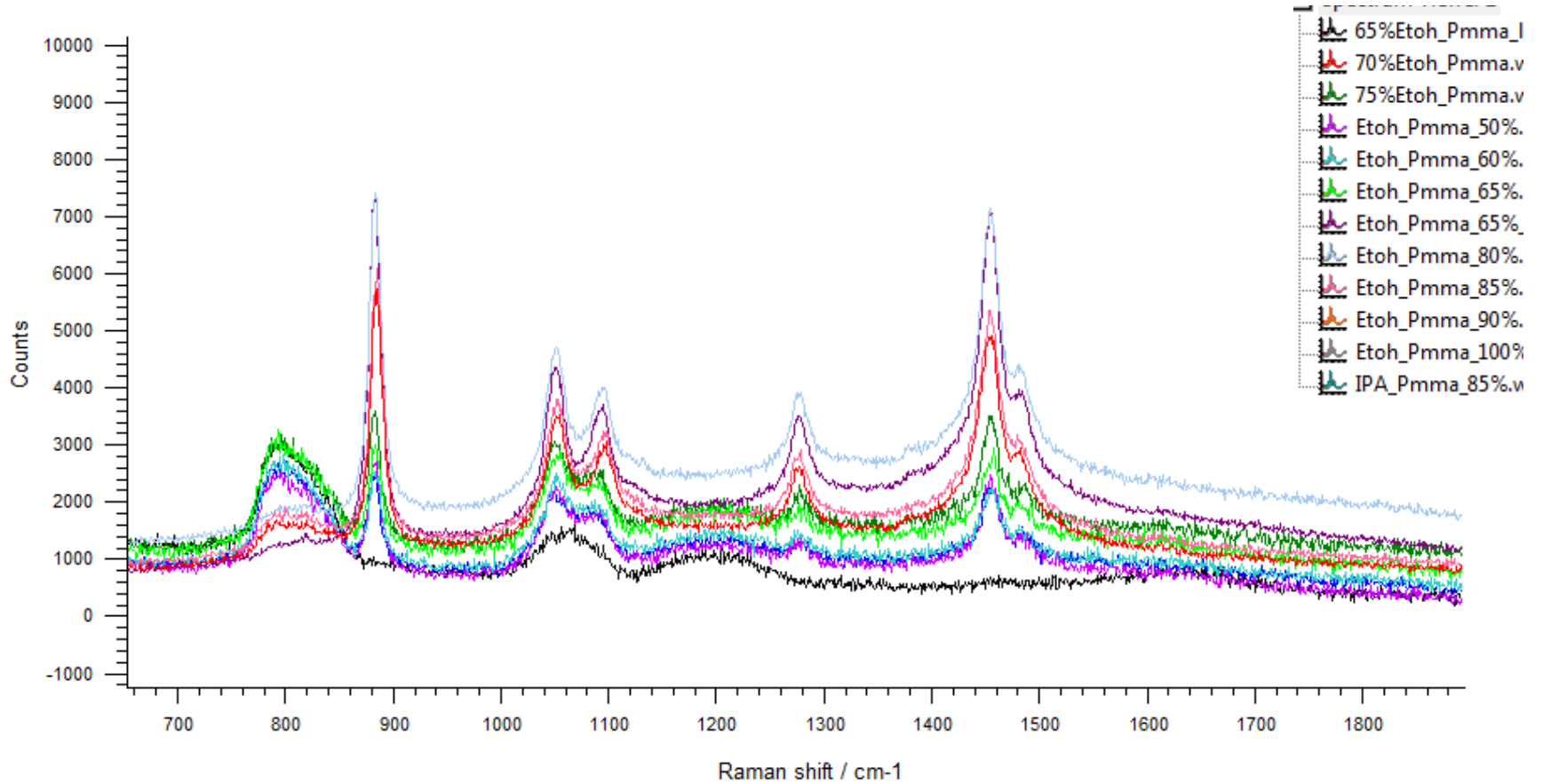
Etoh-PMMA Raman Data



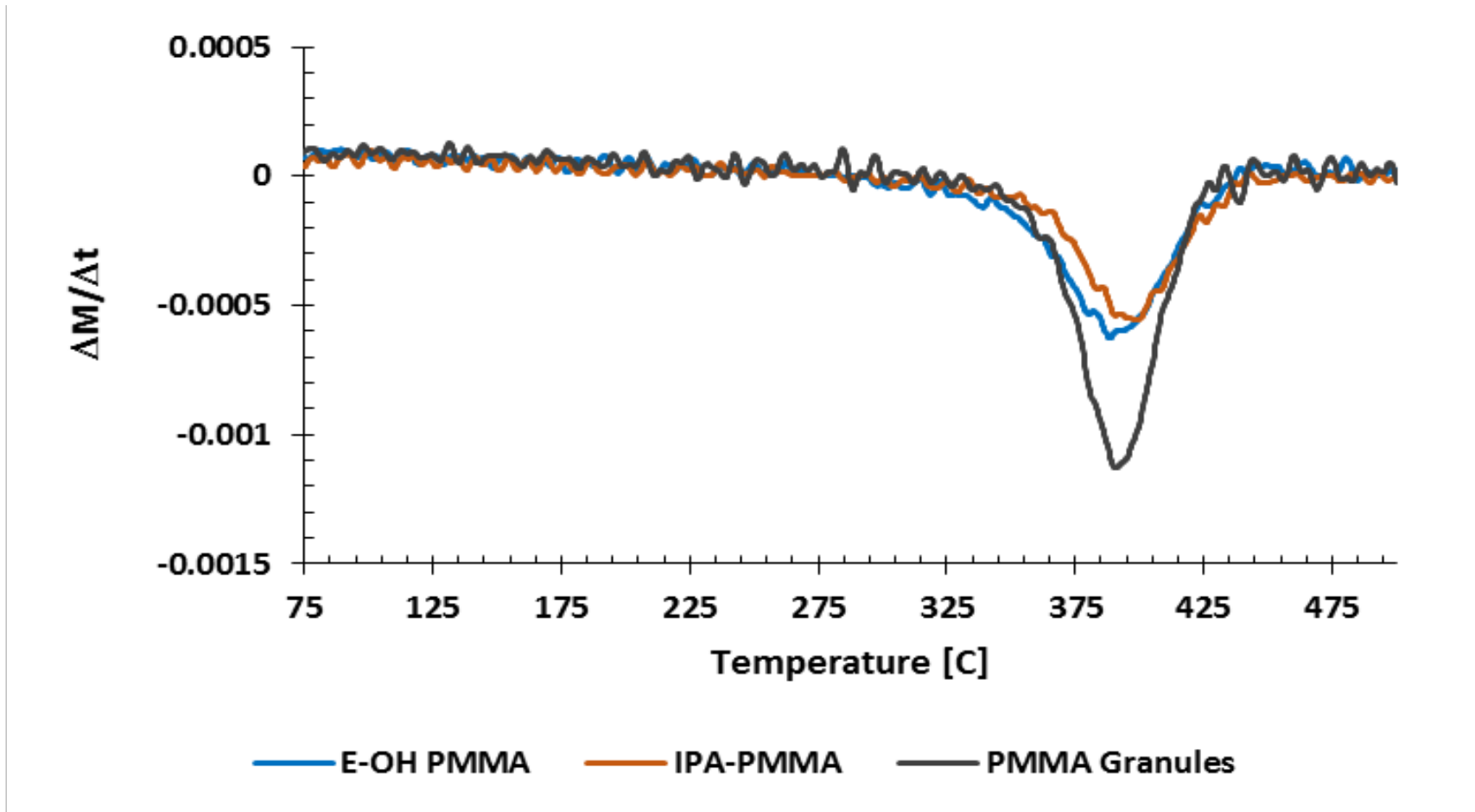
CH and OH stretching bands Etoh



700-1800 Etoh-PMMA



TGA data



Conclusions

- 75%IPA-Water is the ideal ratio for dissolution of PMMA particles.
- 80% Ethanol-Water is ideal for dissolution of PMMA.
- Future investigations may utilize Attenuated Total Reflection (ATR) Raman Spectroscopy and Fourier Transform Infrared Spectroscopy (FTIR).
- There new states in the dissolved PMMA that fluoresce when illuminated with the 514 nm (green) laser which were not observed before.
- Thermal decomposition is different. PMMA decomposes at lower temperatures when dissolved in ethanol-water than the other samples.

References

- Miller-Chou, B. (2003). A Review Of Polymer Dissolution. *Progress in Polymer Science*, 28, 1223-1270.
- Mohammad, M., Muhammad, M., Dew, S., & Stepanova, M. (2011). Fundamentals of Electron Beam Exposure and Development. *Nanofabrication Techniques and Principles*, 11-41.
- Mohammad, M., Dew, S., & Stepanova, M. (2013). SML resist processing for high-aspect-ratio and high-sensitivity electron beam lithography. *Nanoscale Research Letters*, 8, 139.
- Ohmura, R., Takeya, S., Uchida, T., & Ebinuma, T. (2004). Clathrate Hydrate Formed with Methane and 2-Propanol: Confirmation of Structure II Hydrate Formation. *Industrial & Engineering Chemistry Research*, 43, 4964-4966.

Acknowledgements

Questions?