



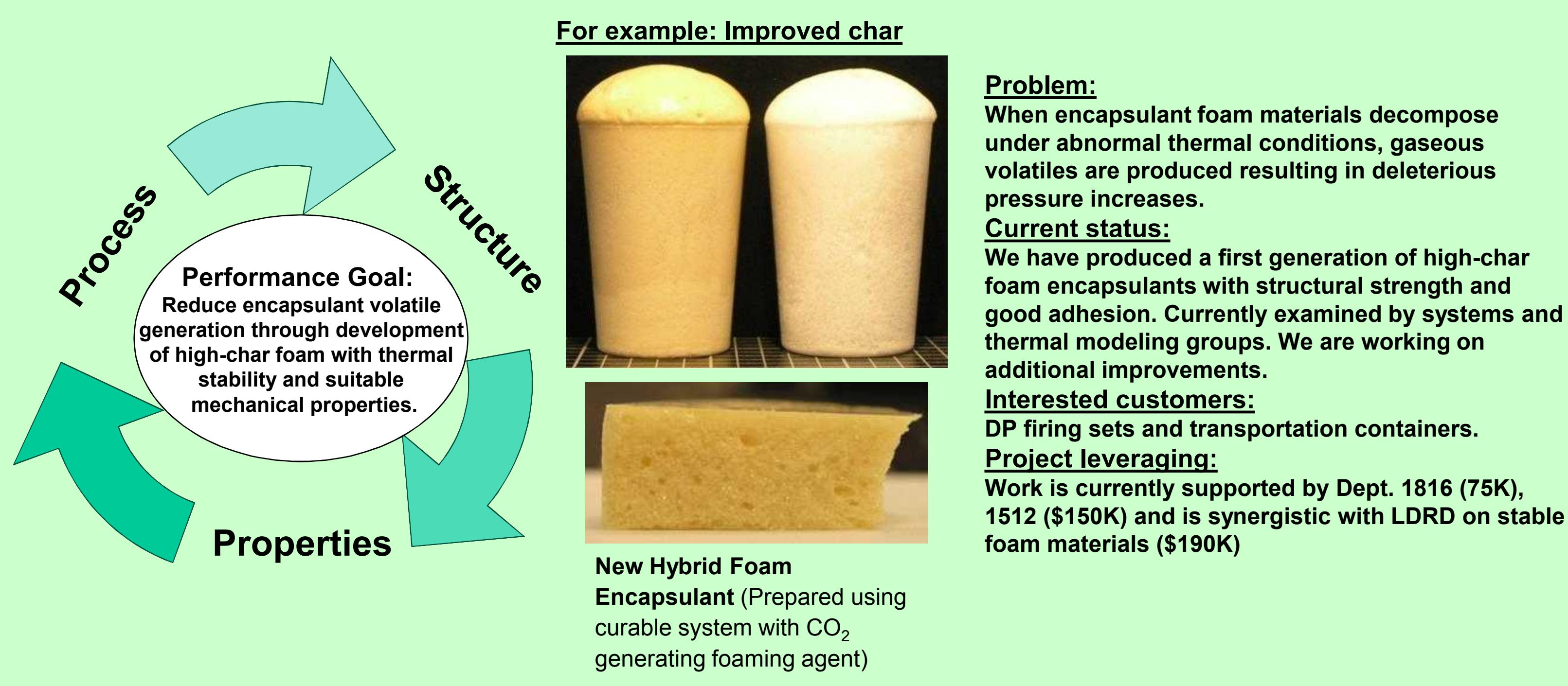
# DEVELOPMENT AND OPTIMIZATION OF INNOVATIVE FOAM MATERIALS

**Mathew Celina, Nick Giron, Ana Trujillo, Sarah Leming, Jim Aubert**  
**Sandia National Laboratories, Albuquerque, NM 87185-1411**

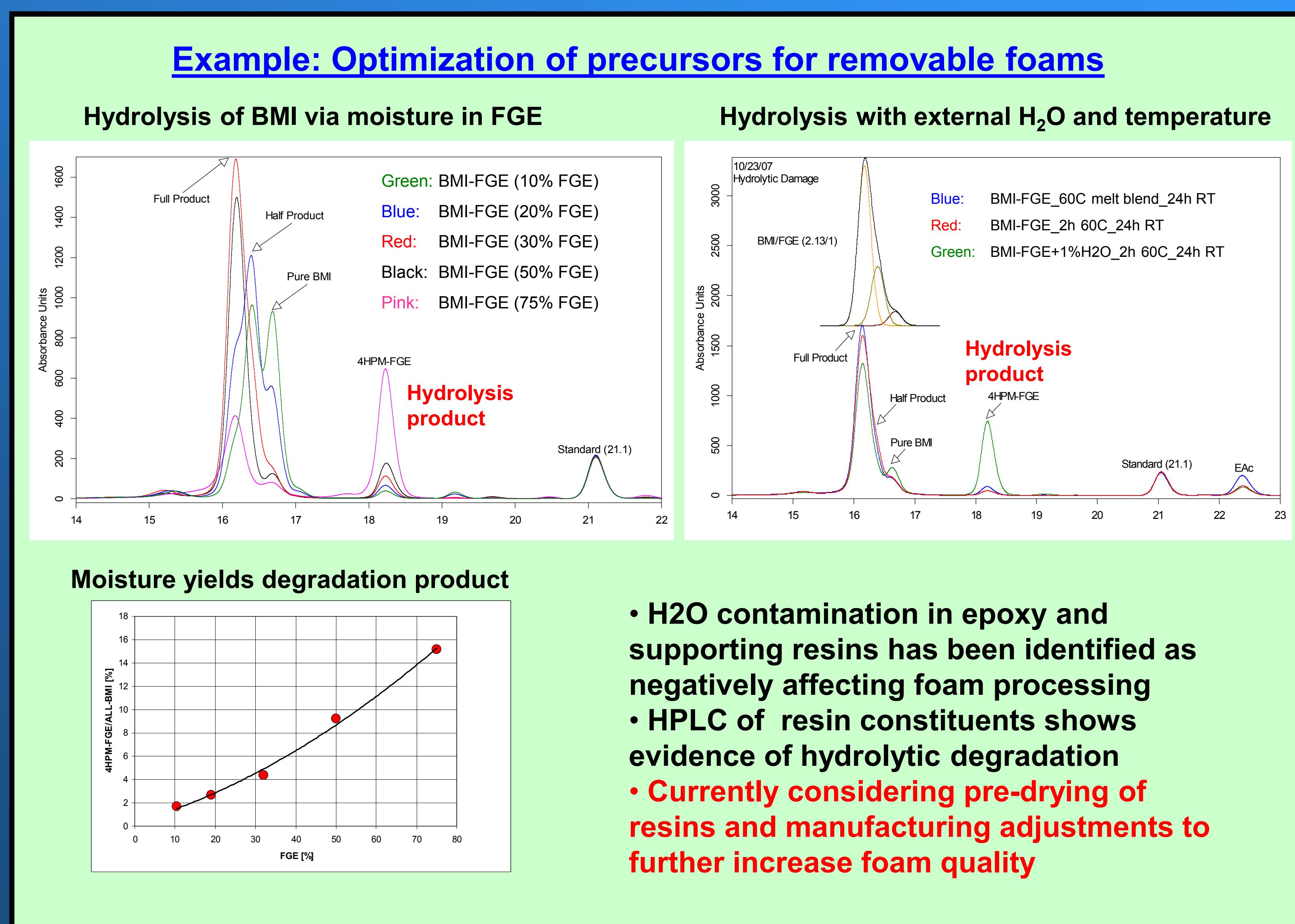


## INTRODUCTION: Foams are Critical Materials

SNL is involved in developing removable foams, high char foam encapsulants, and novel curable resins chemistry resulting in improved foam processing

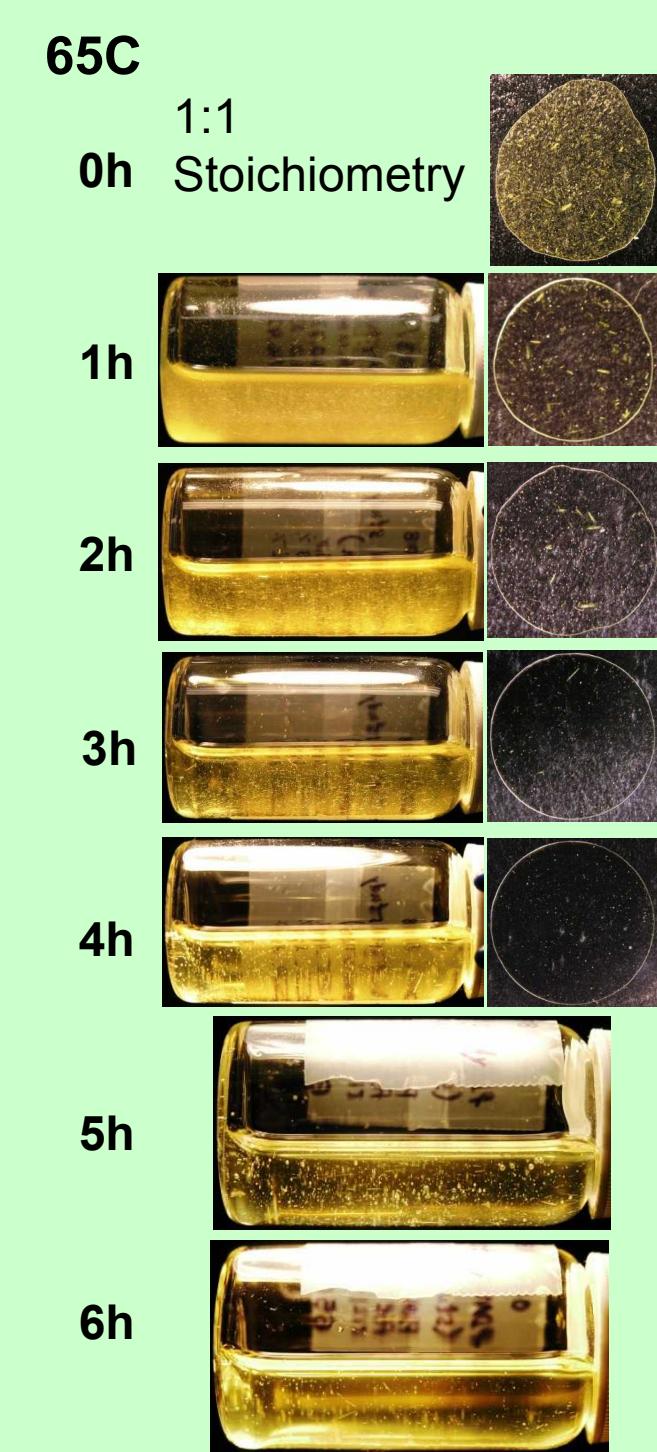


## AIM: Better Performing and Customized Foam Materials

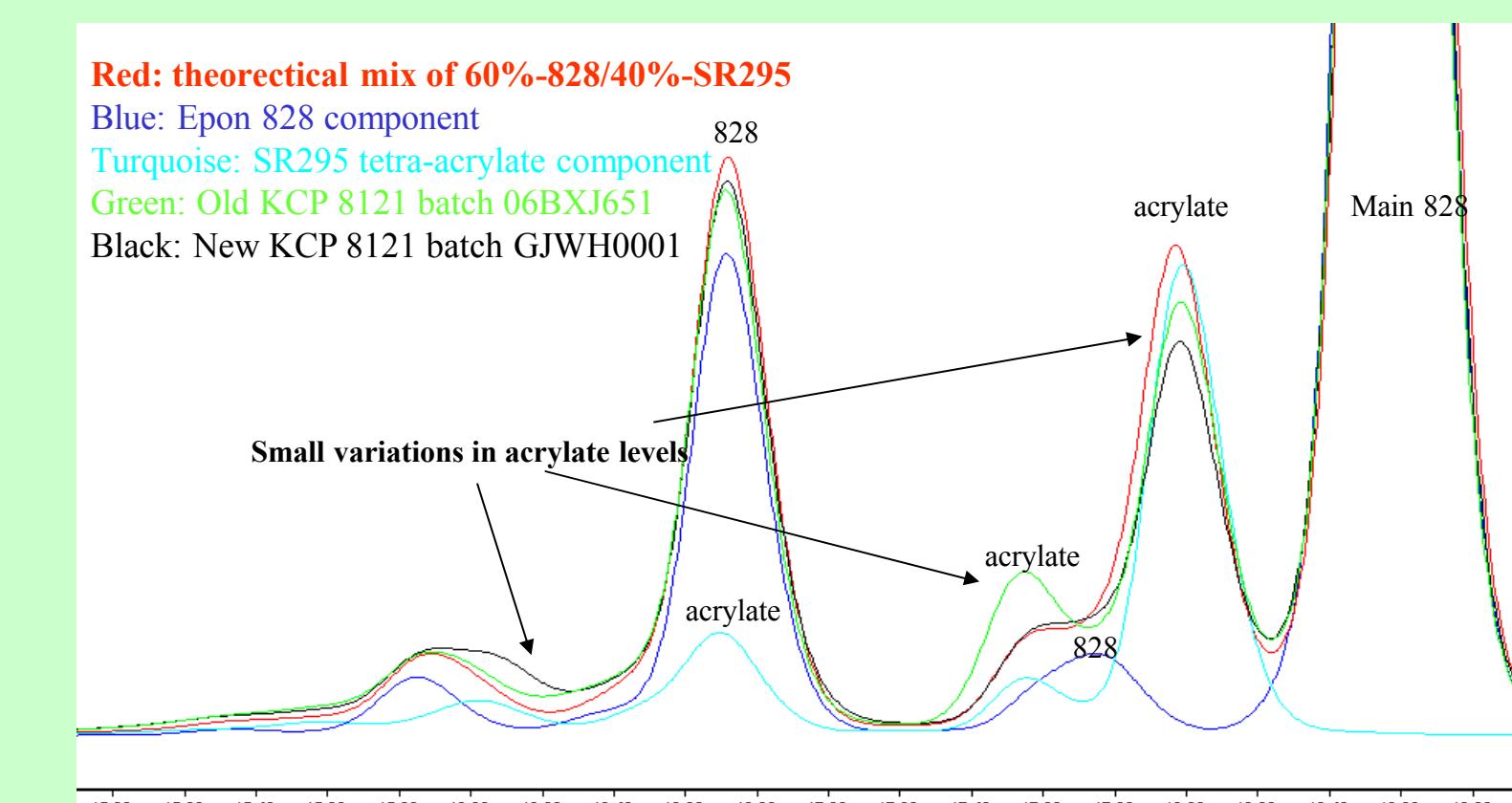


Superior foams depend on many variables:

### Diels/Alder reaction for removability

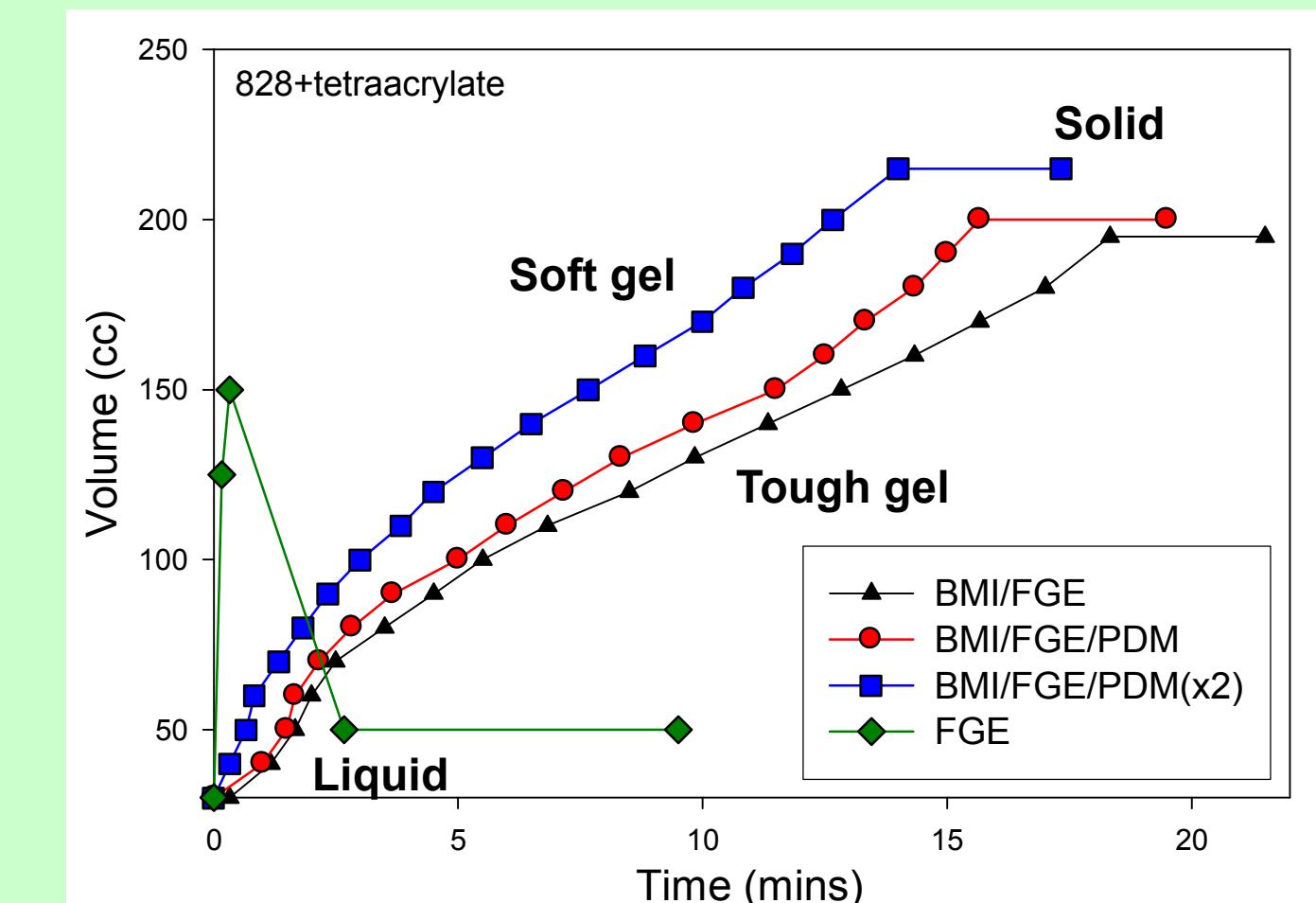


### Constituent synthesis and variability



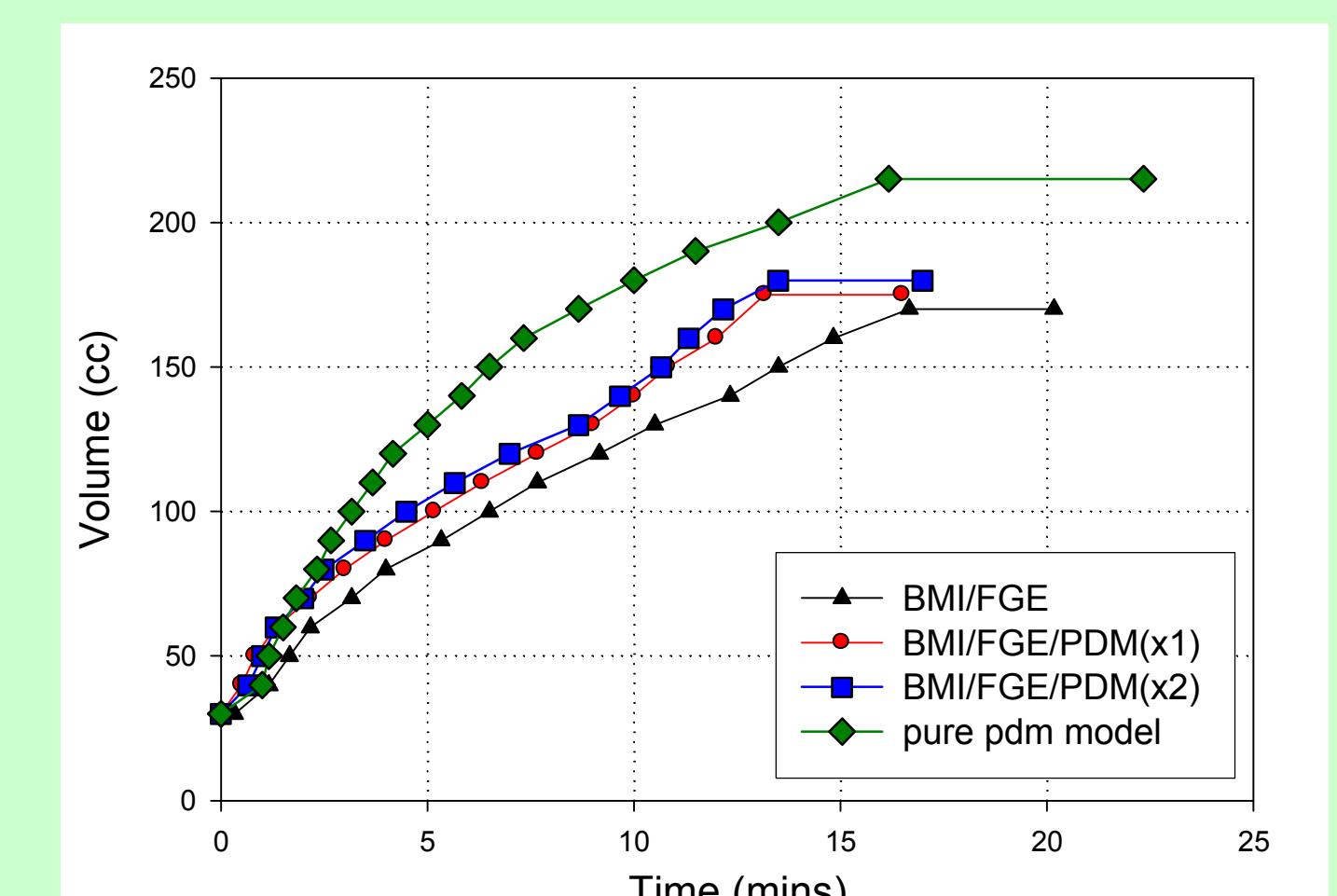
Variations in commercial epoxy resins  
Molecular weight and reactivity per molecule  
HPLC analysis: Chemistry-property correlation

### Foam processing and foaming

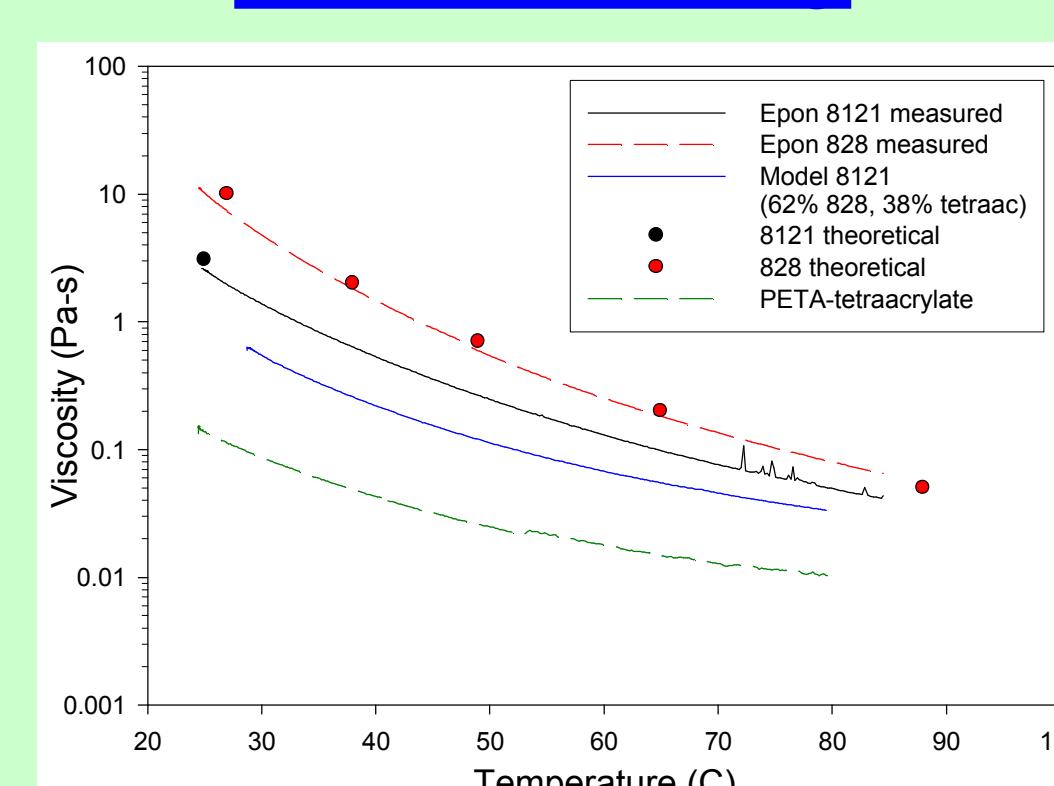


Transition from liquid to solid cured material  
Correlation of foam volume with time  
Depends on constituents, pre-warm and history of pre-cursors

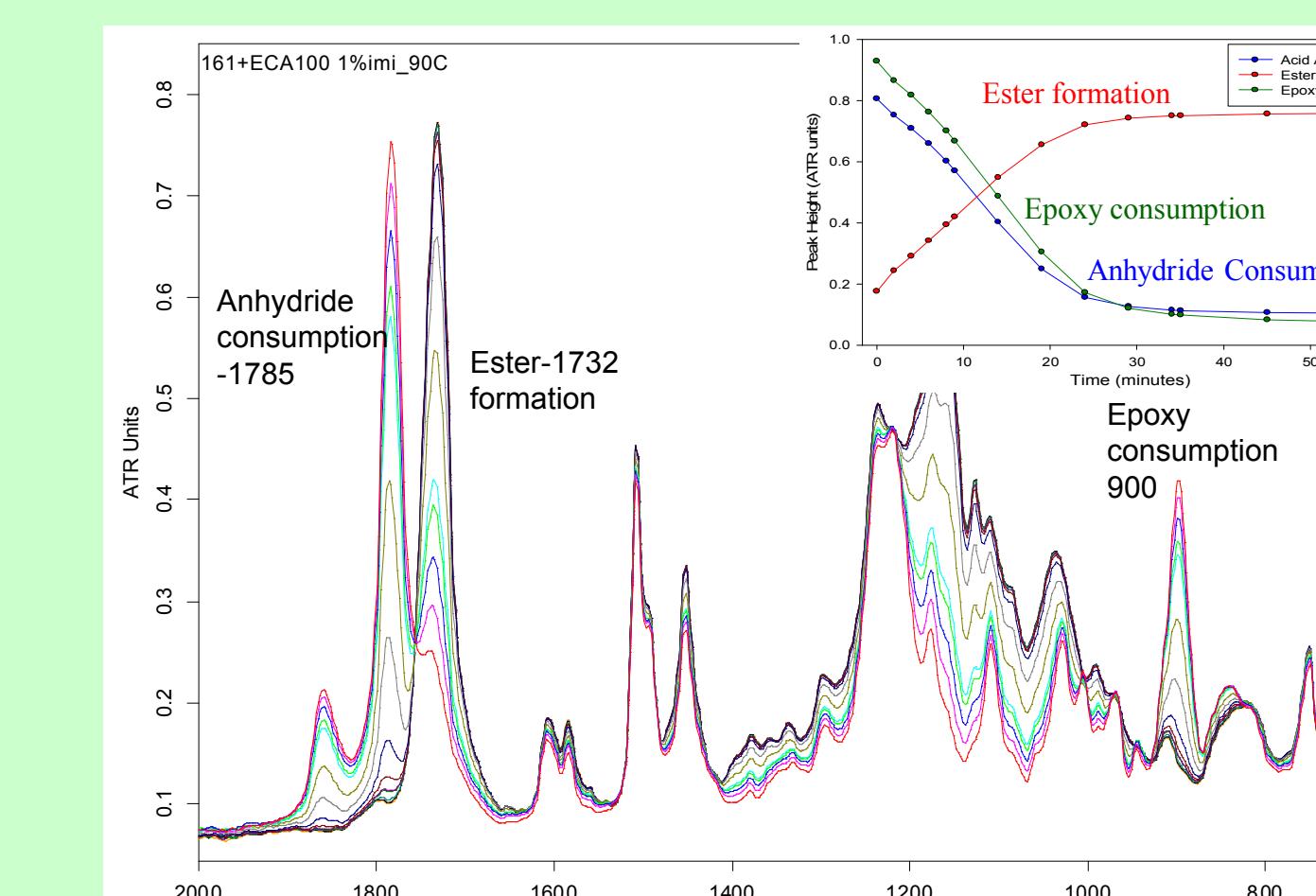
### Influence of individual constituents



### Resin viscosity



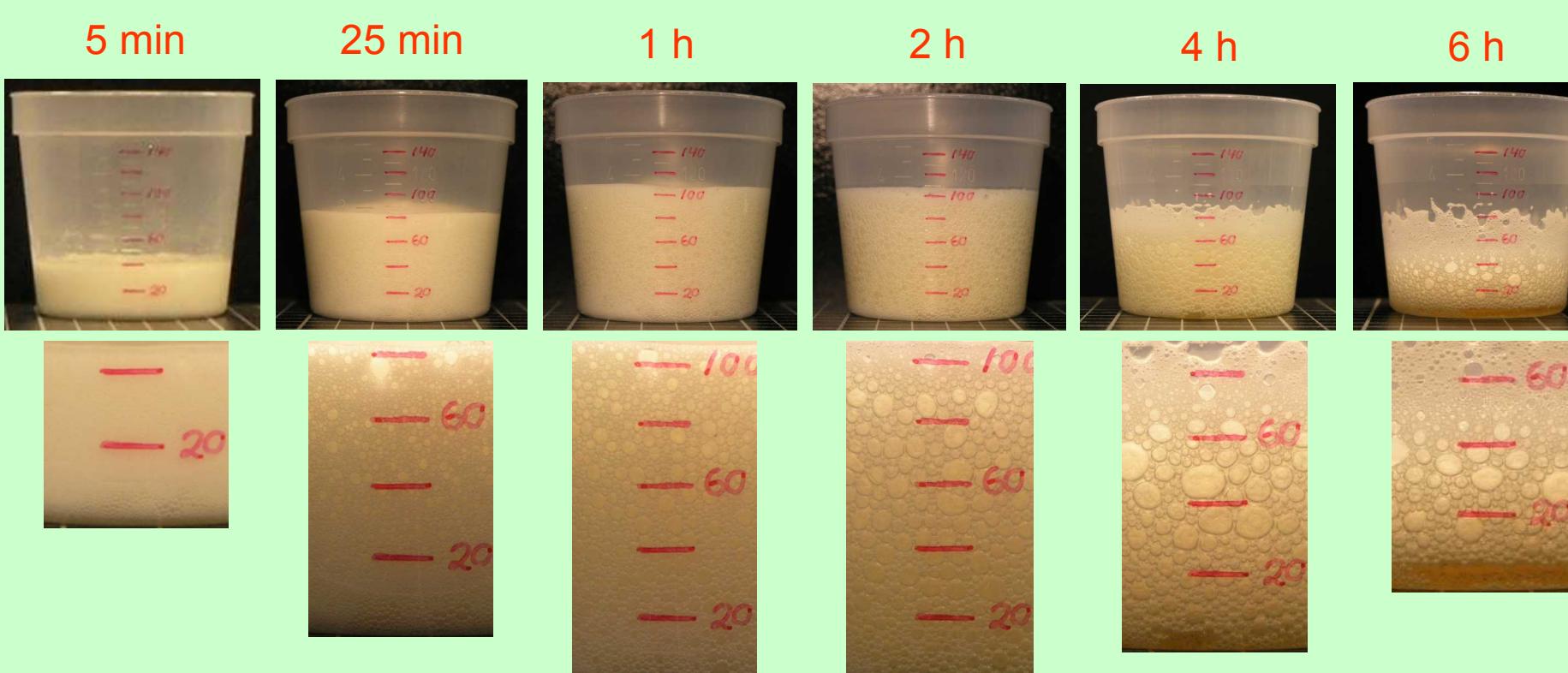
Important viscosity variations affecting foam development



Epoxy and anhydride conversion with  $t, T$

## FUTURE WORK: Foam Stability and Alternative Application (Foam Injection)

### Systematic foam stability assessment on non-curable resins



Foam Volume and Cell Structure as a Function of Time

### Conclusions

- Optimized IR and HPLC analytic techniques to support foam performance studies
- Developed a better understanding of Diels/Alder kinetics, viscosity and influences of foam constituent and their history
- Identified hydrolytic damage from moisture contamination as a contributing factor to foam processing variability
- Developed foams with higher char under pyrolytic degradation
- Evaluated new gas generating reactions and alternative cure processes
- Org 1800 will continue to be instrumental for comprehensive foam optimization and innovative materials development at SNL

### Related References:

**Removing processing variability in removable foam systems: Establishing the fundamental physical and chemical principles for improved foam processing,**  
Mat Celina, Jim Aubert, Sarah Leming, Nick Giron, Organic Materials Dept.1821, JOWOG meeting (2008).