
2004 춘계 화공학회



High Pressure Phase Behavior of CO_2 + Heptadecafluorodecyl (meth)acrylate + poly[Heptadecafluorodecyl (meth)acrylate]

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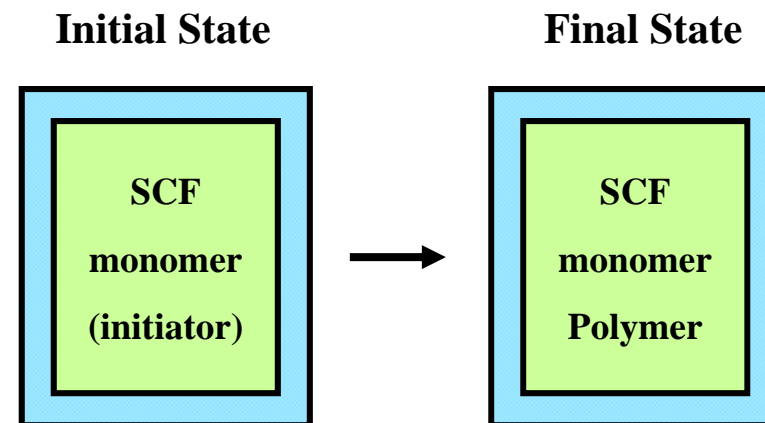


Thermophysical Properties Lab.

Introduction

- For **homogeneous radical polymerization** in **scCO₂**, fluoro monomer must be dissolved in CO₂.

Homogeneous Polymerization



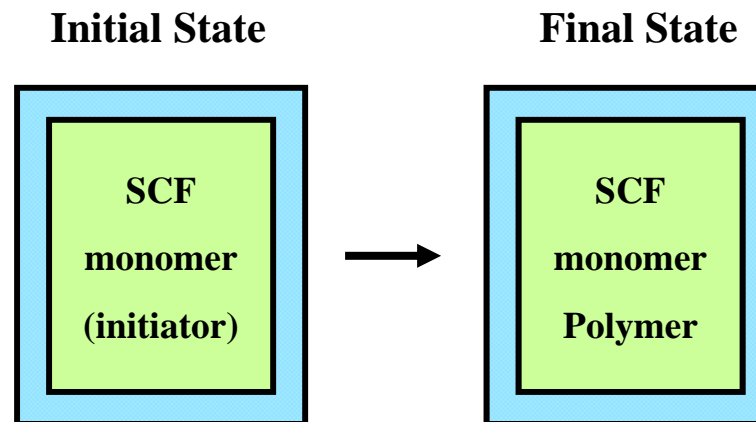
Therefore understanding and predicting the phase behavior of **perfluoro monomer + polymer + CO₂ systems** are important.



Introduction

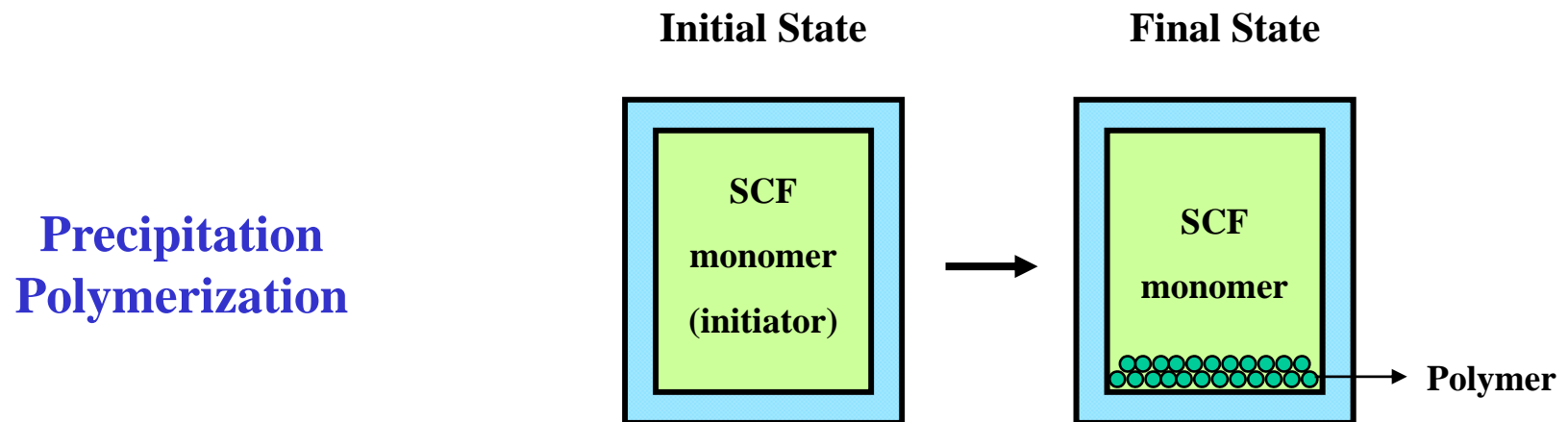
- Recently, **supercritical fluid** is considered as useful alternative of toxic or volatile organic solvents for **polymer synthesis and processing**.
- **scCO₂** is a good solvent for **amorphous fluoropolymers**.
- For **homogeneous radical polymerization** in **scCO₂**, fluoro monomer must be dissolved in CO₂.

Homogeneous Polymerization



Introduction

- For **precipitation polymerization** in **scCO₂**, molecular weight and conversion are determined according to phase behavior of system.



Therefore understanding and predicting the phase behavior of **perfluoro monomer + CO₂ systems** are important.



Application of poly(fluoro acrylate)

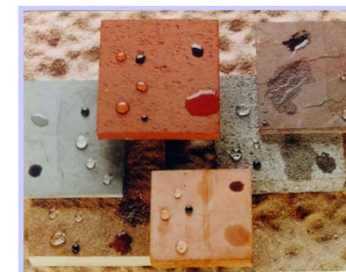
Porous surface protection



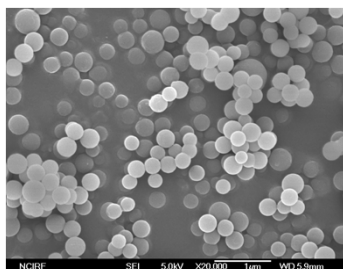
Fiber optics cable



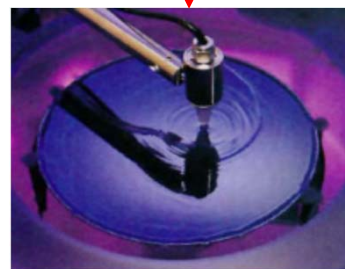
Self dispersed polymers



Polyfluoro acrylate



Dispersant in scCO₂



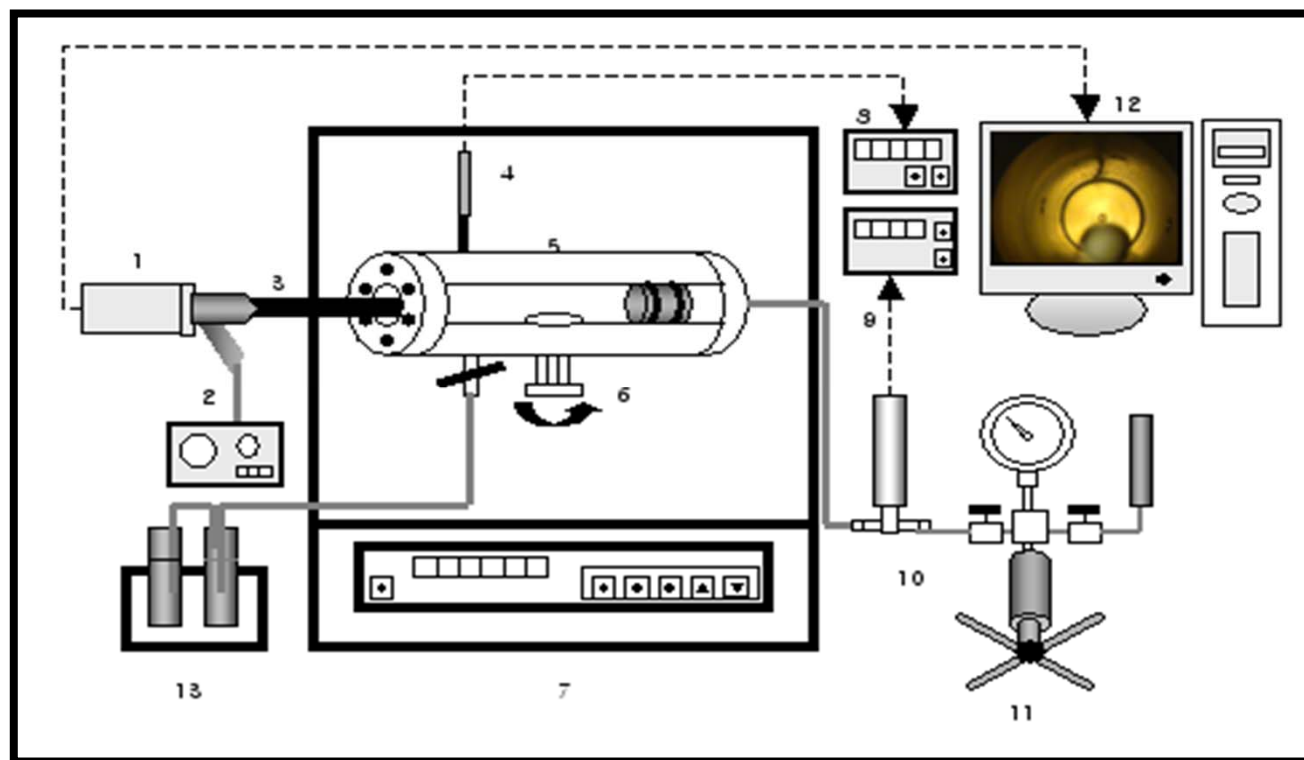
Photoresist



Additive for Latex



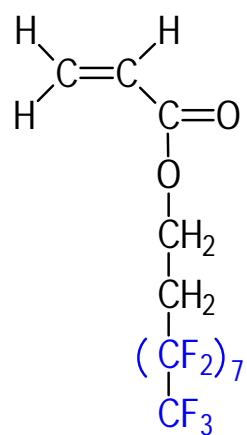
Experimental Apparatus



1. Camera
2. Light source
3. Borescope
4. Thermocouple
5. View cell
6. Magnetic stirrer
7. Air bath
8. Digital thermometer
9. Digital pressure transducer
10. Pressure gauge
11. Hand pump
12. Computer monitor
13. Trap

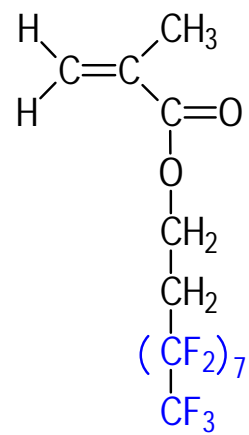
Figure 1. Schematic Diagram of the experimental apparatus





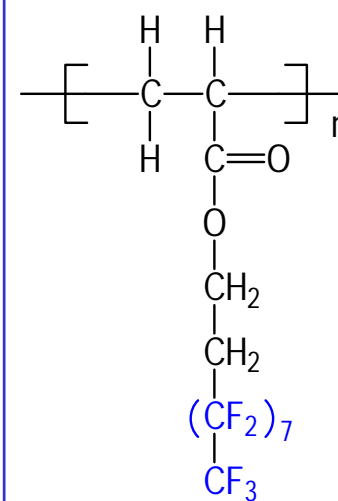
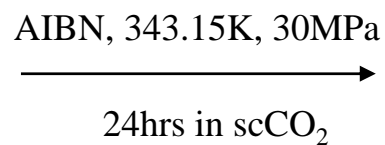
HDFDA

[27905-45-9]

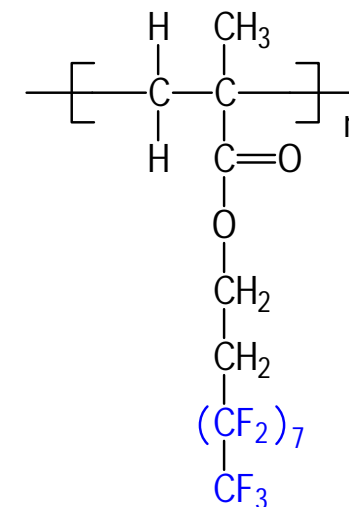


HDFDMA

[1996-88-9]



Poly(HDFDA)

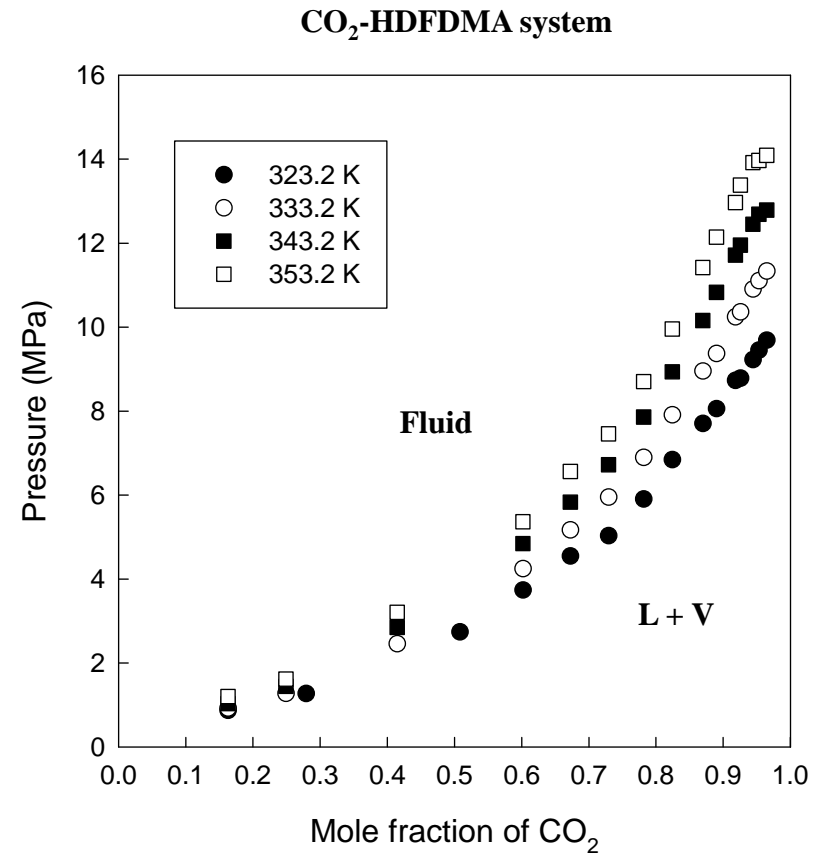
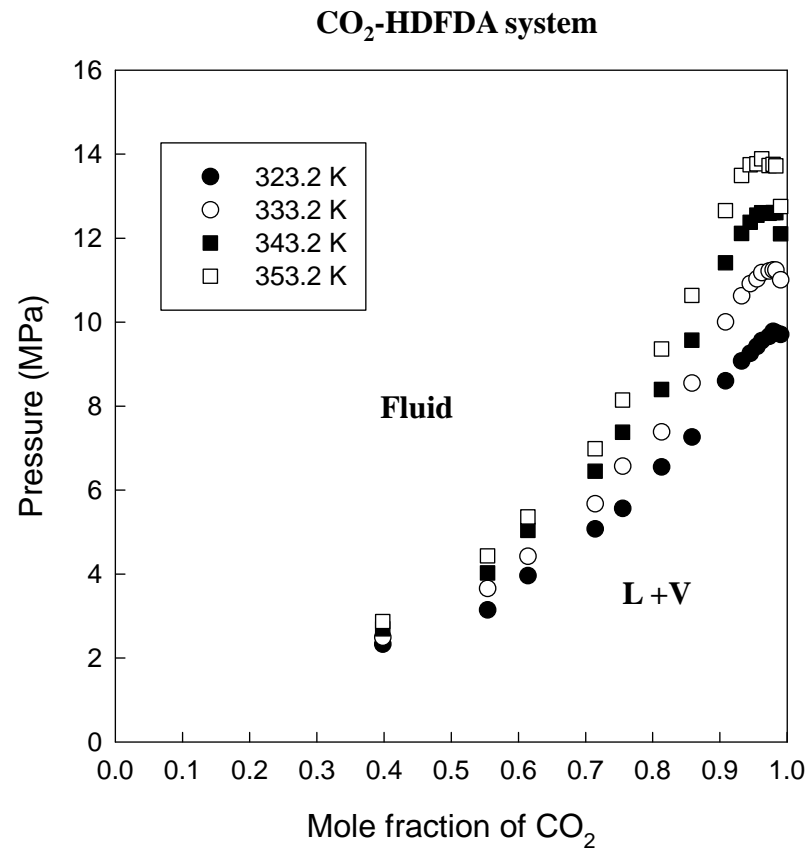


Poly(HDFDMA)

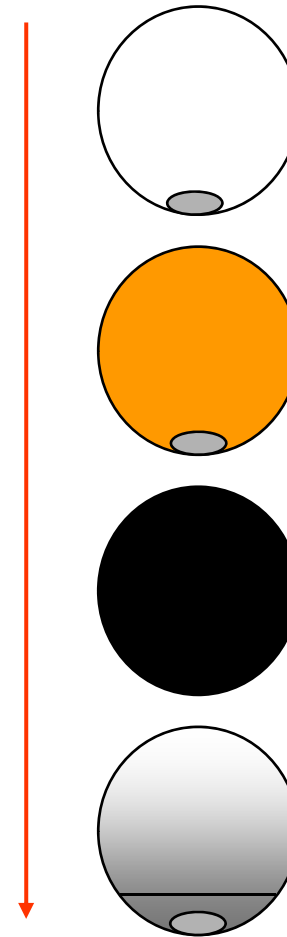
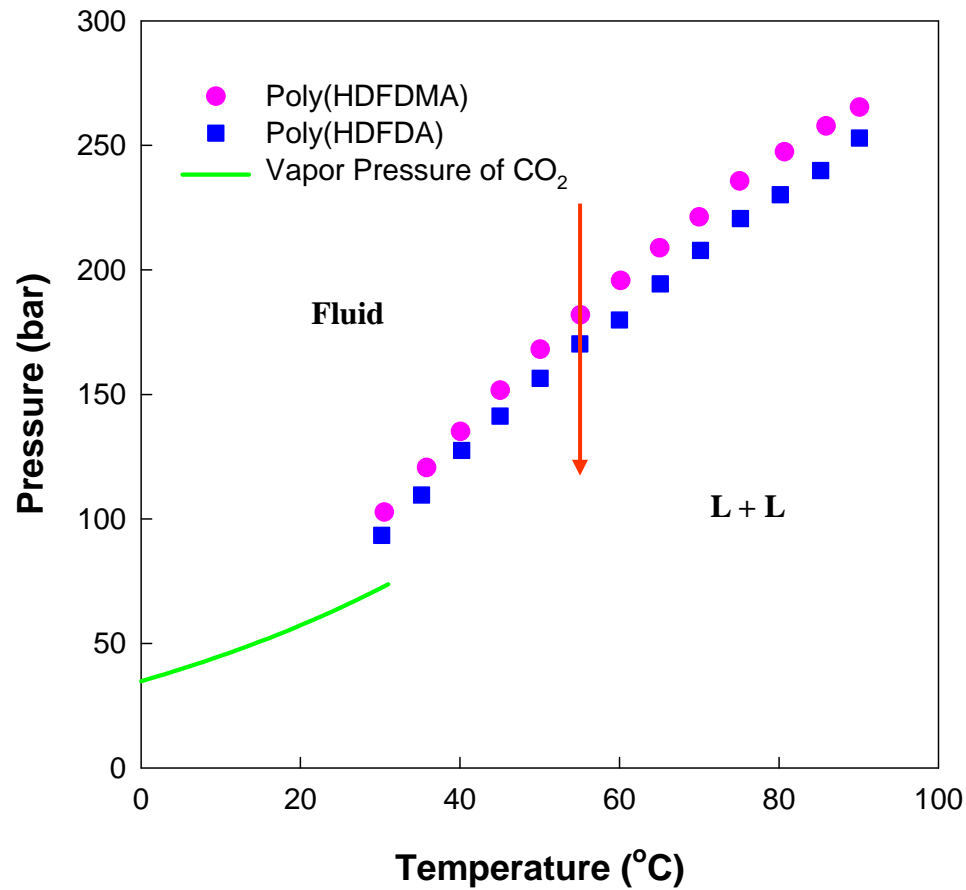
From **Aldrich**



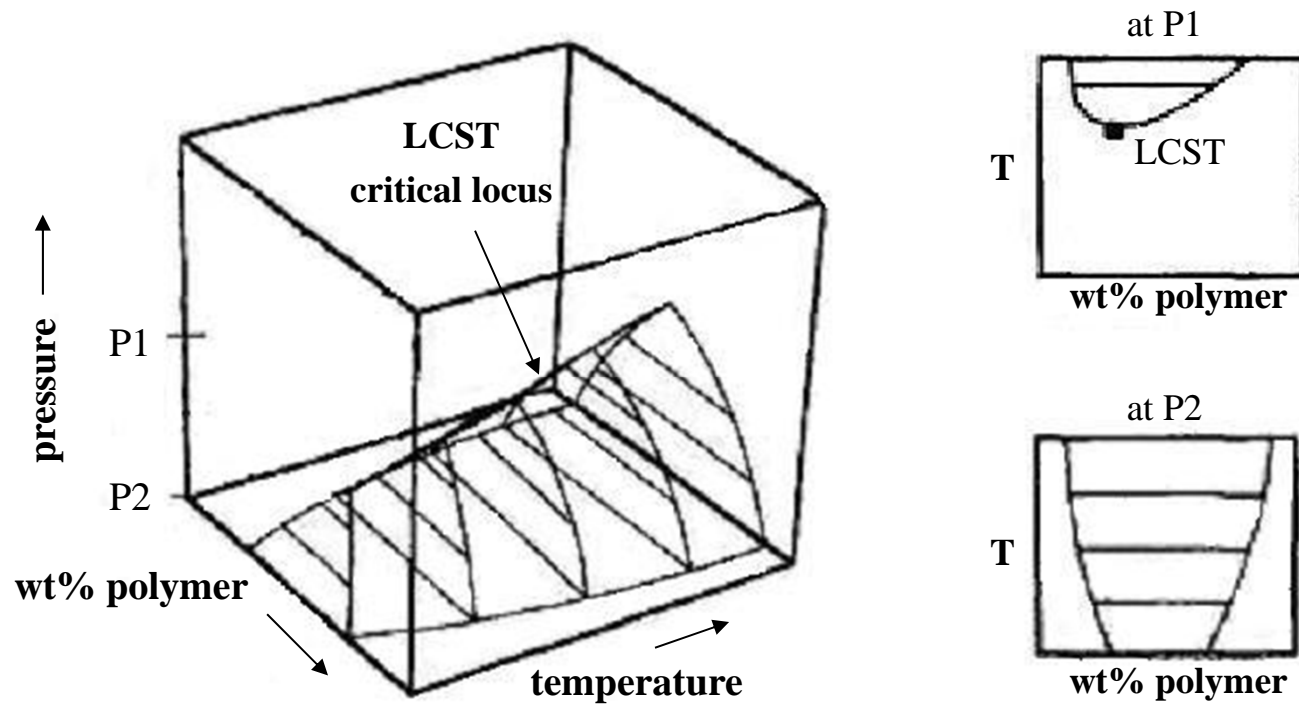
HDFD(M)A + CO₂ system



Poly(HDFD(M)A) + CO₂ system



Phase Diagram of polymer + solvent system



Conclusion

- The phase behaviors of solutions of poly[heptadecafluorodecyl (meth)acrylate] in scCO₂ were studied experimentally using a high pressure variable volume view cell at temperature from 300 to 380K and pressure up to 30MPa.
- *Typical LCST phase behavior and liquid-liquid-vapor transition at high monomer concentration were observed.*

