



Thermoreversible Gelation in Polyhydroxybutyratevalerate

Prashant A. Patil, Dr Ashish Lele and Dr. Jyoti P. Jog,

Polymer Science and Engineering Division,

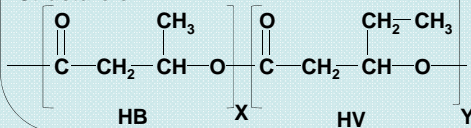
National Chemical Laboratory, Pune



Introduction:

- PHBV is aliphatic polyester synthesized by bacteria.
- Its biocompatibility and biodegradability makes it an attractive tissue engg. material.
- PHBV shows gelation behavior in organic solvents such as Toluene¹, DMF, DMSO etc.

Structure of PHBV:



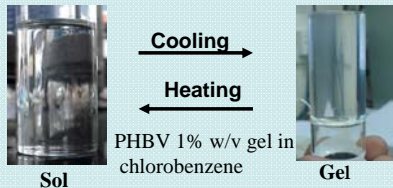
Physical Gel:

Weak gels formed by weak interactions: ionic, H-bonding, Hydrophobic, dispersions, π -stacking².

Chemical Gel:

Gels formed by covalent cross-linking.

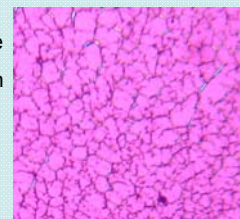
Physical Gelation in PHBV:



Objectives:

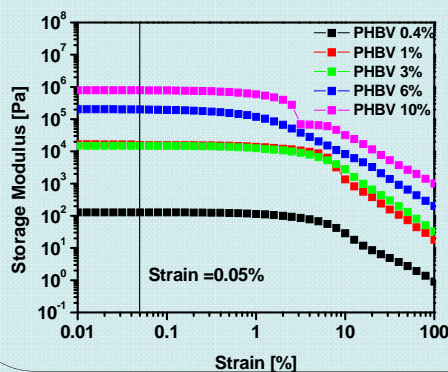
- Investigation of structure formation during gelation process.
- Kinetics of Gelation process.

Optical Micrograph:

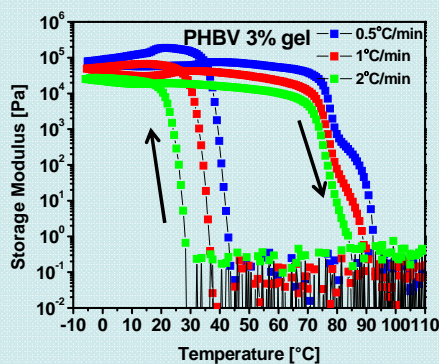


PHBV 1% gel

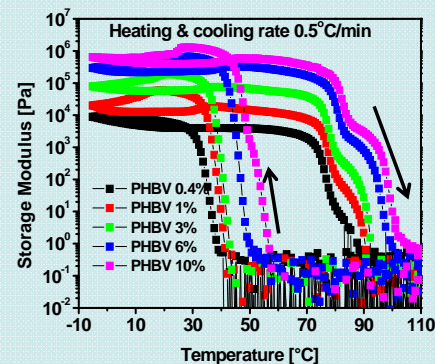
Strain Sweep Experiment



Small Amplitude Oscillatory Shear Experiment: Heating and Cooling Rate Dependence

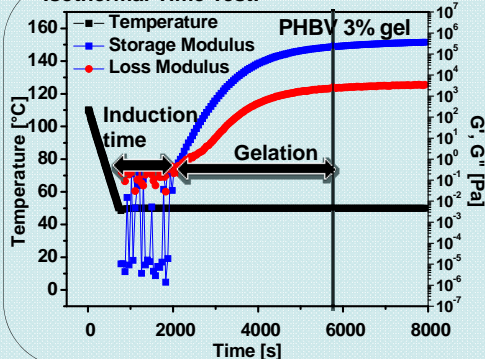


Concentration Dependence of PHBV gel:

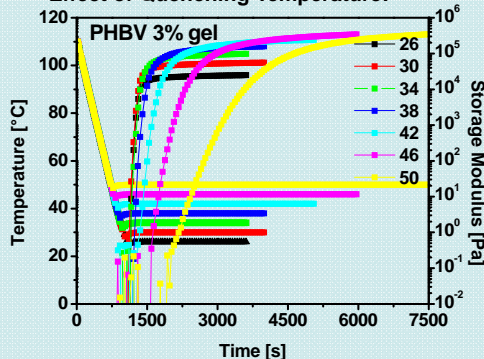


Kinetics of Gelation

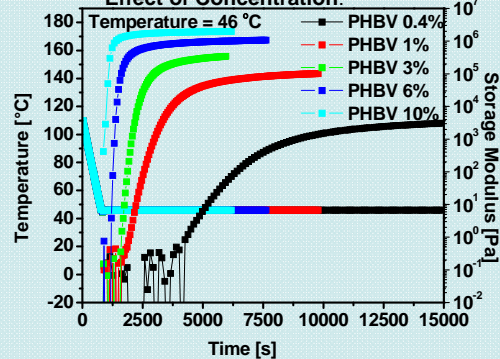
Isothermal Time Test:



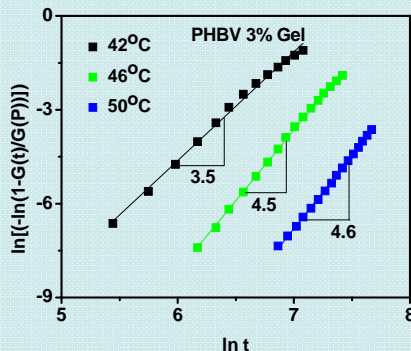
Effect of Quenching Temperature:



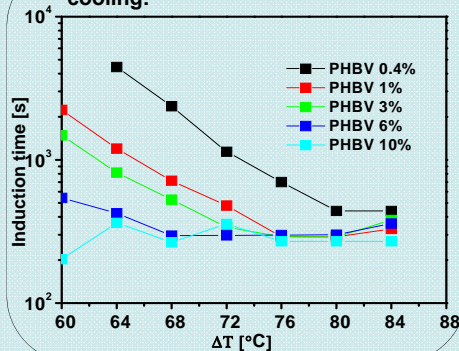
Effect of Concentration:



Avrami Equation:



Induction time vs. Degree of super cooling:



Summary:

- PHBV gels show hysteresis due to phase separation/crystallization in the polymer phase.
- Gel kinetics depends on degree of super cooling and concentration. Higher the degree of super cooling and concentration, faster is the kinetics of gelation.
- Avrami exponents suggest 3-Dimensional growth.

References:

- 1) Andrij Pich, Nadine Schiemenz, Volodymyr Boyko, Hans-Juergen P. Alder, Polymer 47, 2006, 553-560.
- 2) Katsuyoshi Nishinari, Progress in colloid and Polymer Science, 2009, 136,87-94.

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