

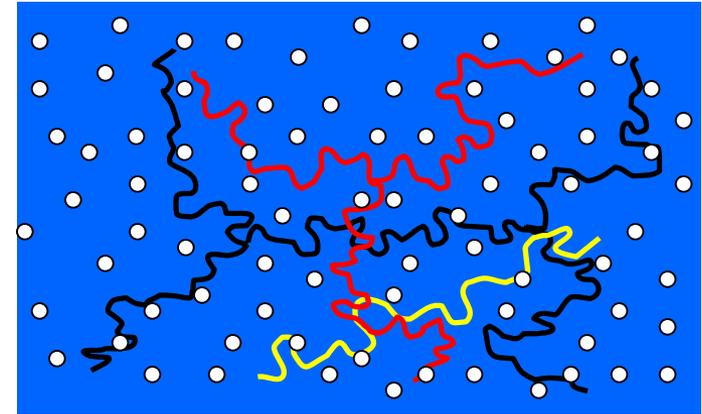
# Analytical rheology of long-chain branched polymers

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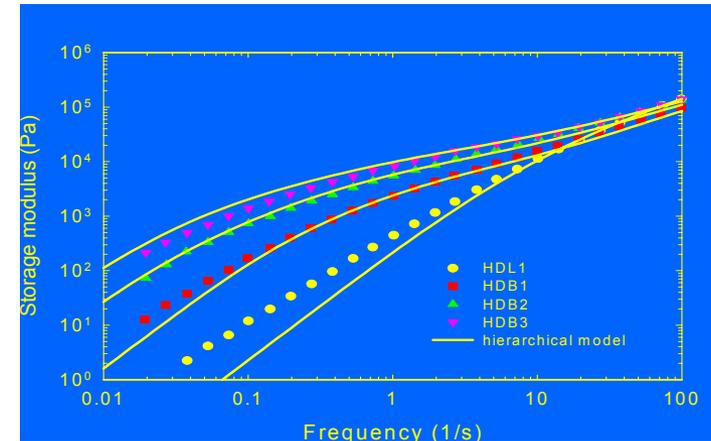
Thanks to advances in catalyst technology, the polymer industry can today make customized polymer structures. It has been known that low levels of branching in polymers has a large effect on many of its mechanical properties like spinnability and strength. The industry is trying to introduce small levels of branching into polymers to tune these properties accurately. However, progress has been slowed by the inability of standard laboratory methods to detect very low levels of branching, sometimes less than 1 branch per 10,000 carbon atoms, and to determine the length and location of these branches. To overcome this problem, we are developing a method to determine branching levels based on rheology, since rheology is very sensitive to polymer structure and details of branching. We are developing a theoretical method to relate rheological properties to the level and type of long-chain branching in polymers.

*Macromolecules*, **34**, 4556-4571 (2001)

*J. Rheol.*, **47**, 199-211 (2003)



A schematic for the general mixture of the long-chain branched polymers.



Hierarchical model predictions for metallocene-catalyzed long-chain branched polyethylenes

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## Education

A postdoc (Dr. Seung Joon Park), two graduate students (Sachin Shanbhag and Youngsuk Heo) and an undergraduate student (Chris Rentsch) have been part of this work. Grad student Shanbhag had the opportunity to visit and work with the Doi Research group at Nagoya University, Japan in 2002.

## Compendium of LV data

We have compiled a large database (Excel Files) of linear viscoelastic data available in literature. It may be downloaded for use from:

<http://www.engin.umich.edu/dept/che/research/larson/melt.html>

	A	B	C	D	E
1	<b>Species</b>	PBd			
2	<b>Temp</b>	25C			
3	<b>Me</b>	1543 (Fetters, McLeish uses 1850, kinda consistent)			
4	<b>G' 0</b>	1.15 MPa (McLeish use with 1.2 factor of 1.25MPa)			
5	<b>Reference</b>	Daniels et. al., Macromolecules, 2001, 34 (7025)			
6					
7	<b>PBC2</b>				<b>PBC3</b>
8	$\omega$	<b>G*</b>	$\omega$	<b>G**</b>	$\omega$
9	/s	Pa	/s	Pa	/s
10	6.1200E-04	3.5165E+04	6.1200E-04	6.3455E+04	1.4700E-03
11	9.7000E-04	4.3905E+04	9.7000E-04	8.1835E+04	2.6100E-03
12	1.5400E-03	6.3868E+04	1.5400E-03	1.0300E+05	4.6500E-03
13	2.4400E-03	9.4629E+04	2.4400E-03	1.3100E+05	8.2600E-03
14	3.8600E-03	1.3900E+05	3.8600E-03	1.5300E+05	1.4690E-02

Screenshot from a typical file from the database.