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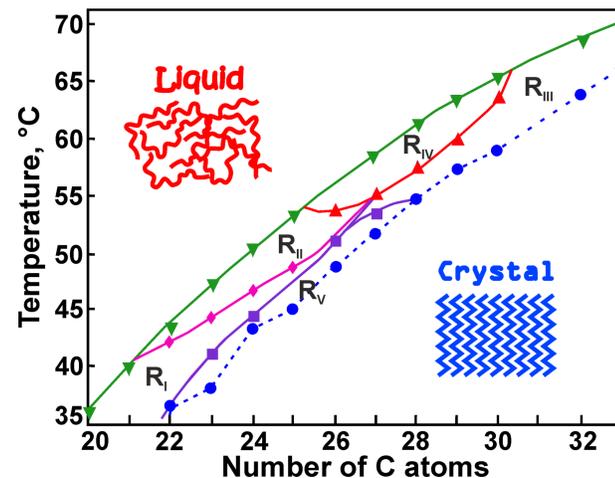
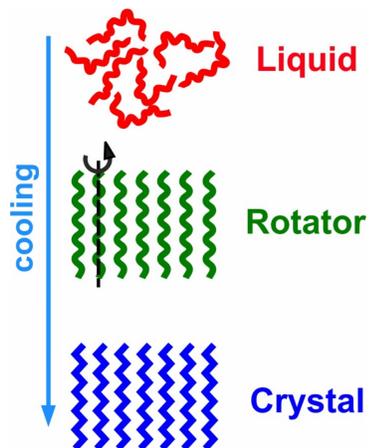
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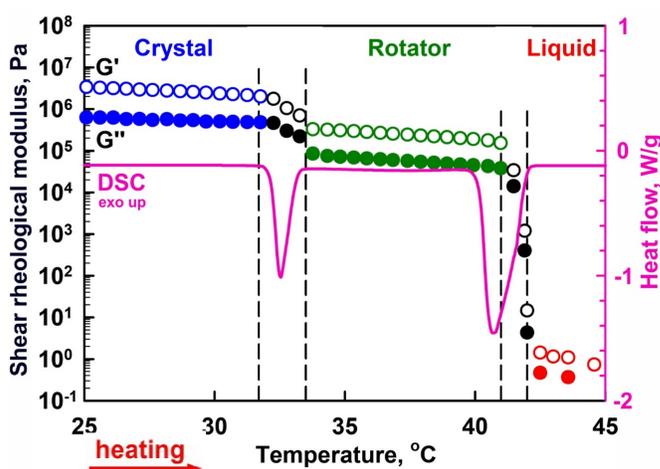
Summary

- Temperature dependence of the rheological properties of rotator and crystalline phases is studied under shear.
- Shear moduli of the crystal phases (C) do not depend on the type of the crystalline lattice.
- Shear moduli for the rotator phases (R) depend on the chain length and the subcooling of the phase from melt.
- The R phase moduli decrease for longer alkanes due to the presence of more conformational defects in the molecules.
- The moduli increase upon cooling, $G'_R \approx 0.1$ to 1 MPa and $G''_C \approx 0.5$ -3 MPa. The loss moduli are 3-4 times lower.

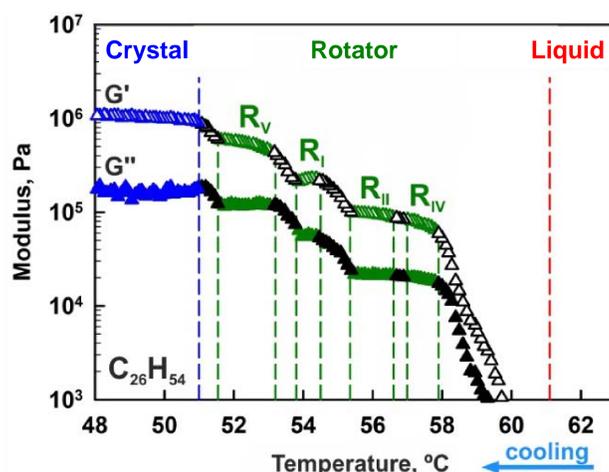
Rotator phases in alkanes



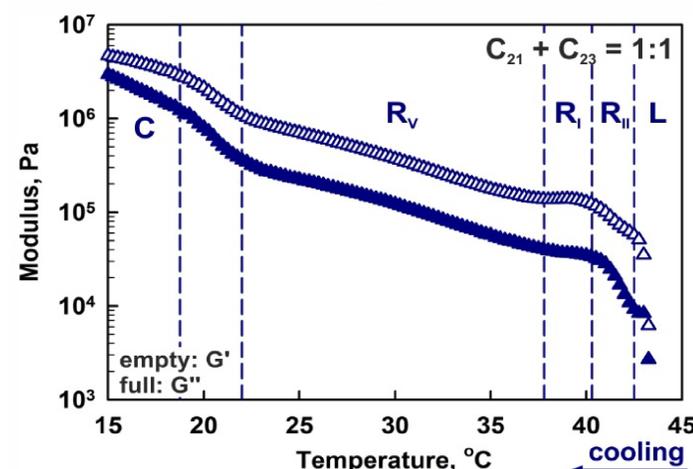
Heneicosane (C₂₁H₄₄)



Hexacosane (C₂₆H₅₄)

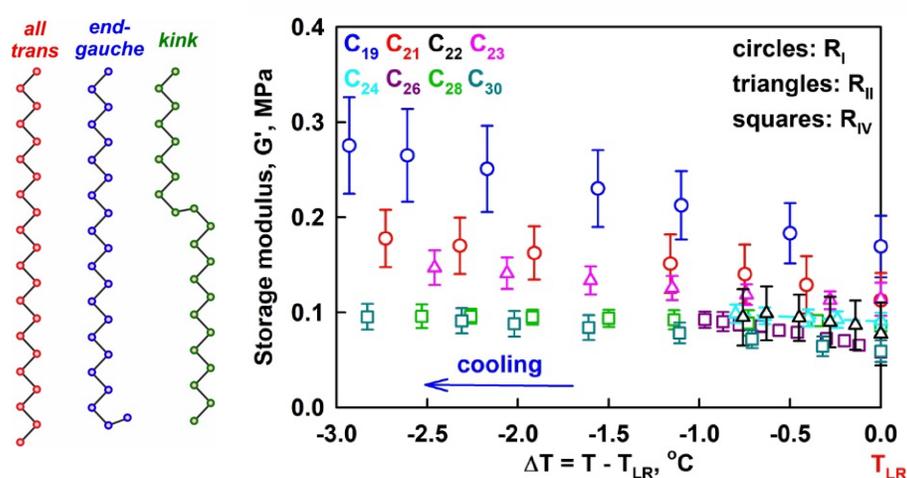


Alkane mixture



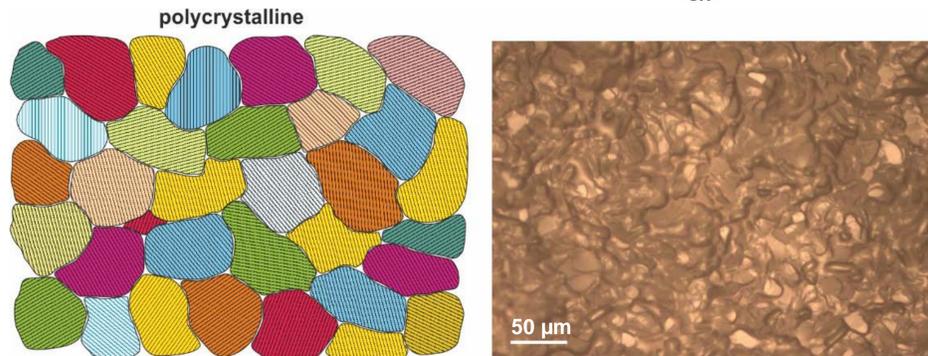
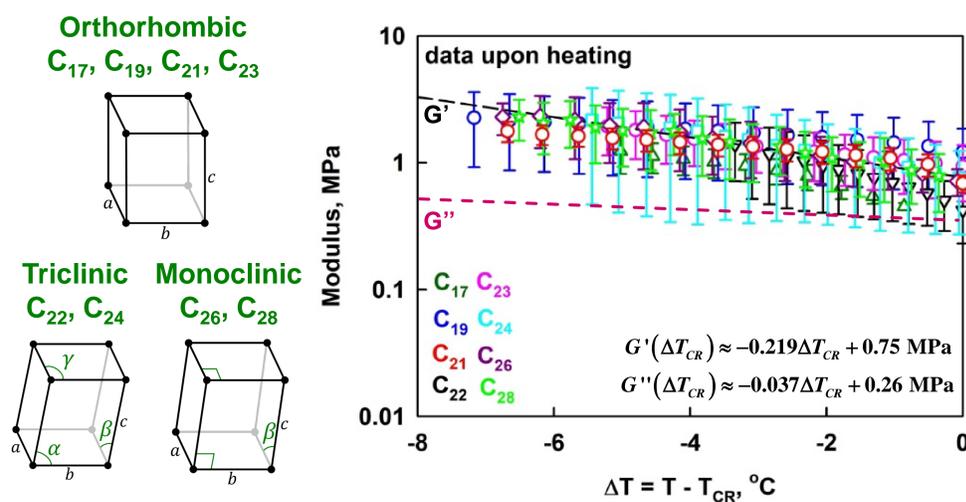
The performed rheological measurements detect all phase transitions occurring in the samples. Stepwise increase in the G' and G'' moduli is observed upon $L \rightarrow R$, $R \rightarrow C$ and part of the R -to- R transitions. In other R -to- R transitions, only slope change of the moduli is observed.

Rotator phases comparison



The number of kinks (defects) increases with the increase of alkane chain length. This softens the respective plastic structures and lowers the values of measured moduli.

Crystalline phases comparison



The observed trend can be explained assuming that the shear moduli values are determined mainly by the friction between the distinct crystalline domains in the polycrystalline structure. The number of conformational defects in C structures is similar.

Materials and methods

- Materials: long chain alkanes, C_n, n = 17-30; C_{20:1}; Vaseline
- Methods:

Rheological measurements upon cooling and heating

Rate: 0.5°C/min
Frequency: 1 Hz
Amplitude: 0.05%



Differential scanning calorimetry



Acknowledgements:

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References:

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- T. Goworek et al., *J. Phys.: Conf. Ser.* 265 2011, 012023.