



## Mendil et al Reply

H Mendil, Laurence Noirez, P Baroni, I. Grillo

### ► To cite this version:

H Mendil, Laurence Noirez, P Baroni, I. Grillo. Mendil et al Reply. Physical Review Letters, 2007, 98 (24), pp.249802. 10.1103/PhysRevLett.98.249802 . hal-01361945

**HAL Id: hal-01361945**

**<https://hal.science/hal-01361945>**

Submitted on 7 Sep 2016

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Mendil *et al.* Reply:** In the preceding Comment [1], Collin and Martinoty claim that a conventional flow behavior ( $G' \sim f^2$ ,  $G'' \sim f$ ) is obtained at 20  $\mu\text{m}$  gap thickness, for a LC-polymer (LCP105) in the nematic phase, using a filling with a capillary, whereas a solidlike behavior ( $G' \sim Cst$ ,  $G'' \sim Cst$ ) is observed by approaching two parallel surfaces to the sample (as we apply in our experiment). Our observations of a terminal solidlike behavior are thus interpreted by Collin and Martinoty as an anomaly induced by compression effects.

We clearly refute this interpretation.

We note that, on Fig. 13 and 14 of a previous paper written by Collin and Martinoty [2], they report no more a conventional flow but an elastic behavior at lower temperature using the capillary filling and the same polymer (LCP105). Their previous observations are thus in contradiction with their present purpose; i.e., a terminal flow behavior.

We are not convinced that the capillary filling is a stress-free method. In this method, the nematic polymer is guided by the capillary forces between the glass plates of the piezorheometer. The polymer is strongly surface constrained, and very likely, the nematic phase is aligned during this process. Do the authors look at an orientational effect of the nematic polymer? Does the resulting flow behavior depend on the sample orientation? Or on the capillary forces-diameter tube-plate spacing? Where is the sensor? What are the stress values at the beginning of the filling, after a certain delay (relaxation)?

We have access *in situ* to the compression forces measured via the normal contact forces (the ARES rheometer is equipped with a vertical force sensor centered on the rotational axis). In our experiments, the normal forces are within the limits of the sensitivity (about 1–10 g). No increase of normal forces is observed when a sample exhibits a gel-like, a solidlike, or a liquidlike behavior. The compression effect cannot explain the solidlike behavior observed in the isotropic phase of PAOCH3 (which is chemically very different from LCP105).

Our protocol uses side-opened fixtures, large thickness samples, and includes a long waiting time (typically 40 000 s). These conditions and the absence of further evolution ensure the relaxation from eventual previous stresses.

Collin and Martinoty claim that the comparison between LCP105 measured at 20  $\mu\text{m}$  and PAOCH3 is valid since we show that the solidlike behavior is measured for thicknesses ranging from 25 to 300  $\mu\text{m}$  [3]. It is shown (see

inset Fig. 1c of Ref. [3]) that the elastic response is weakening at large thicknesses (typically 0.5 mm) giving rise to the observation of a conventional flow behavior. The above proposition to generalize a result whatever the thickness, is contradicting with respect to both ours and the observations of a thickness dependence that they published in previous papers.

Martinoty and Collin conclude their Comment by repeating that the solidlike behavior reported by Mendil *et al.* is a rheological artefact, whereas the demonstration of their claim is still missing. They did not work with the LC-polymer (PAOCH3) presented in [1]. (We keep this sample at their disposal to allow a more relevant discussion.)

From the comparison of the results obtained at low gaps with various samples, we conclude that the terminal elastic behavior depends on the chemical nature. We have observed that a gel-like behavior is observed rather with cyano-biphenyl LC-polymers [4], whereas a solidlike behavior is obtained for methoxy-phenyl benzoate LC-polymers [5]. In all cases, a similar filling procedure is applied and a conventional flow behavior is obtained at large gaps.

Finally, if we would have observed, as Collin and Martinoty do, stresses persisting during 6 days, far away from the glass transition, we would suggest that the supposed flowing materials present an unexpected stress memory. This would be our interpretation and also our conclusion.

H. Mendil,<sup>1</sup> L. Noirez,<sup>1,\*</sup> P. Baroni, and I. Grillo<sup>1,†</sup>  
<sup>1</sup>Laboratoire Léon Brillouin (CEA-CNRS) Ce-Saclay  
91191 Gif-sur-Yvette Cédex, France

Received 13 October 2006; published 15 June 2007

DOI: [10.1103/PhysRevLett.98.249802](https://doi.org/10.1103/PhysRevLett.98.249802)

PACS numbers: 61.30.Vx, 61.12.Ex, 83.60.Bc, 83.85.Cg

\*[laurence.noirez@cea.fr](mailto:laurence.noirez@cea.fr)

<sup>†</sup>Present address: Institut Laue Langevin, BP156, 38042 Grenoble Cédex 09, France.

- [1] D. Collin and P. Martinoty, preceding Comment, Phys. Rev. Lett. **98**, 249801 (2007).
- [2] D. Collin and P. Martinoty, Eur. Phys. J. E **19**, 87 (2006).
- [3] H. Mendil, P. Baroni, L. Noirez, Eur. Phys. J. E **19** 77 (2006).
- [4] H. Mendil, P. Baroni, L. Noirez, Europhys. Lett. **72** 983 (2005); L. Noirez, Phys. Rev. E **72** 051701 (2005).
- [5] H. Mendil, L. Noirez, P. Baroni, and I. Grillo, Phys. Rev. Lett. **96** 077801 (2006).