

Comment on “Glass-Specific Behavior in the Damping of Acousticlike Vibrations”

In a recent Letter [1], Rufflé *et al.*, collecting literature data on the high frequency dynamics on different glasses, reported on a correlation between the energy position of the “boson peak” (BP) and the Ioffe-Regel energy. The first quantity, $E_{BP} = \hbar\Omega_{BP}$, is taken as the energy position of the maximum of the function $g(\omega)/\omega^2$, where $g(\omega)$ is the density of vibrational states. The second quantity, $E_{IR} = \hbar\Omega_{IR}$, is defined by the authors as the energy pertaining to the longitudinal acoustic modes that fulfill the condition $\Gamma = \Omega/\pi$ (here Γ is the FWHM of the peak centered at Ω). Plotting the quantity E_{IR} against E_{BP} the authors of Ref. [1] find a correlation [see Fig. 1(a)] strongly suggesting that $E_{IR} = E_{BP}$ for a large class of glasses.

Examining the current literature, including the papers cited in Ref. [1], we reached the following conclusions. (i) Other systems can be added to the plot: some data were not known to Rufflé *et al.* at the time of their submission (NiZr [2], GeO₂ [3]), while other glasses were not included (CKN [4]). All of these three new systems do not fit to the correlation [systems 11, 12, and 13 in Fig. 1(b)]. (ii) The point for *d*-SiO₂ was misplaced [5]. Figure 3 of Ref. [1] shows $E_{BP} = 6.9$ meV, while in the paper (cited in [1]) the reported value is $E_{BP} = 8.5$ meV [11]. Once correctly placed *d*-SiO₂ [system 3 in Fig. 1(b)] violates the correlation. (iii) The system reported as polycarbonate—and hence classified as a polymer—(Ref. [40] in [1]) is actually propylene carbonate, a molecular glass former, and the E_{IR} reported in [1] has been measured in the liquid phase. We added to Fig. 1(b) the point for *glassy* [12] propylene carbonate [system 6 in Fig. 1(b)] which now does not fit to the correlation. (iv) Finally, for lithium-

borate glasses the BP positions reported by Rufflé and co-workers were taken from Raman spectra. It is well known that the quantity measured in Raman scattering is *not* $g(\omega)/\omega^2$, but $g(\omega)C(\omega)/\omega^2$, and that the presence of the Raman coupling coefficient $C(\omega)$ shifts toward higher energy the position of the maximum of $g(\omega)/\omega^2$. It is, therefore, misleading to put in the same plots E_{BP} data coming from Raman spectra and from the maximum of $g(\omega)/\omega^2$. We report on Fig. 1(b) the data for the two lithium-borate glasses using the E_{BP} values derived from inelastic neutron scattering [13]. The points no longer lie on a line.

Summing up, on the basis of Fig. 1(b) one can conclude that (i) no correlation exists between E_{IR} and E_{BP} , and (ii) the Ioffe-Regel limit for almost all the investigated glasses lies *above* the boson peak position.

We thank L. Bove and F. Sette for useful discussions.

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Received 8 April 2006; published 13 February 2007

DOI: 10.1103/PhysRevLett.98.079601

PACS numbers: 63.50.+x, 78.35.+c, 81.05.Kf

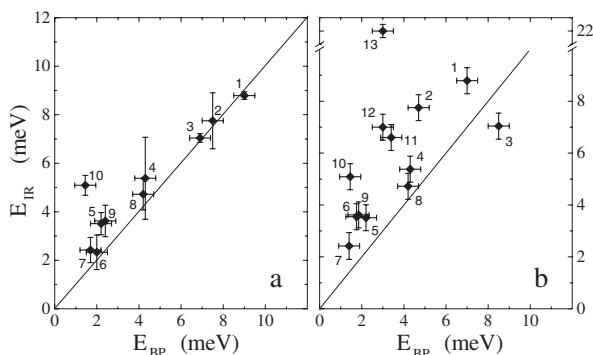


FIG. 1. Ioffe-Regel energy vs the BP energy for different glasses according to: (a) Rufflé *et al.* [1] and (b) literature data. Labels are 1—Li₂O-2B₂O₃, 2—Li₂O-4B₂O₃, 3—*d*-SiO₂, 4—*v*-SiO₂, 5—PB, 6—PC, 7—Se, 8—glycerol, 9—ethanol, 10—oTP, 11—GeO₂, 12—CKN, 13—NiZr. In panel (b) the error bars have been set to ± 0.5 meV for all of the data.

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- [5] The placing of other systems can be questioned. Specifically, for selenium Ref. [1] reports $E_{IR} = 2.4$ meV and $E_{BP} = 1.7$ meV, while literature data are $E_{IR} = 3.3$ meV [6] and $E_{BP} = 1.4$ meV [7]. In the case of glycerol, the literature reports a T -independent E_{IR} [8] and a strong T dependence of E_{BP} [9]. For ethanol, E_{BP} is 1.8 meV [10], not 2.4 meV as reported in [1].
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