

bromophenol but the yield of  $\text{Br}^-$  expected from this source is only  $\sim 0.1$ . We see no reason to question that the residual yield of H of  $\sim 0.5$  in fact represents a single species.

This work was supported in part by the US Atomic Energy Commission.

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Received January 3, 1972.

- <sup>1</sup> Kongshaug, M., Steen, H. B., and Cercek, B., *Nature Physical Science*, **234**, 97 (1971).
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It was recently shown that the reaction  $e_{aq}^- + \text{H}_3\text{O}_{aq}^+$  does not yield H atoms and that the major fraction of the residual hydrogen in  $^{60}\text{Co}$ -radiolysed water is not H atoms<sup>2</sup>. In the preceding letter, however, Neta, Fessenden and Schuler dispute these conclusions<sup>1</sup>; we here point out that there is at present no reason for such doubt.

We studied the reactions of radiation-induced intermediates with  $\text{BrP}$  occurring at times  $\leq 10^{-5}$  s (see ref. 2). The steady state ESR experiments of Neta *et al.*<sup>1,3</sup>, however, do not allow observation of intermediates with lifetimes shorter than  $5 \times 10^{-5}$  s, as was also realized by Neta *et al.* in their previous work<sup>3</sup>. The conclusion from their ESR experiments that  $e_{aq}^- + \text{H}_3\text{O}_{aq}^+$  yields H atoms is thus equivalent to disregarding any short lived radiolytic intermediates. What Neta *et al.* have shown is that the sequence of events generated by the reaction  $e_{aq}^- + \text{H}_3\text{O}_{aq}^+$  ultimately yields H atoms. This has already been suggested by Cercek<sup>4</sup> and by no means contradicts the contents of our work<sup>2,5</sup>. The species produced by  $e_{aq}^- + \text{H}_3\text{O}_{aq}^+$ , presumably  $\text{H}_3\text{O}_{aq}^+$  radicals, however, participate in chemical reactions at times shorter than  $10^{-5}$  s (ref. 2). Consequently, it is the decay of these radicals, and not  $e_{aq}^- + \text{H}_3\text{O}_{aq}^+$ , that yields H atoms.

It is misleading to state that "Kongshaug *et al.* base their conclusions on the fact that only a low yield of  $\text{Br}^-$  is produced in the irradiation of acidic solutions of p-bromophenol . . ."<sup>1</sup>. We have stated that our conclusions are based on the finding that there is a zero yield of  $\text{Br}^-$  from the reaction of  $\text{H}_3\text{O}_{aq}^+$  radicals with  $\text{BrP}$  at all  $\text{pH} < 7$ , while H atoms react with  $\text{BrP}$  to produce an equivalent amount of  $\text{Br}^-$  at all  $\text{pH} < 7$  (ref. 2). The technique used for the study of the reactions of H atoms with  $\text{BrP}$  is simple<sup>5,6</sup>, and the results were quantitatively accounted for in a simple way<sup>5</sup>. The  $\text{BrP}$  system has by now been studied in considerable detail<sup>2,5-9</sup>. The experimental evidence indicates that the measurement of  $\text{Br}^-$  yields in irradiation solutions of  $\text{BrP}$  affords a useful probe for the study of fundamental processes in the radiation chemistry of aqueous solutions.

Neta *et al.*<sup>1</sup> have misinterpreted our results<sup>2</sup> which indicate that the residual hydrogen represents two different species, with  $G_{\text{H}} = 0.17$  and  $G_{\text{H}_3\text{O}_{aq}^+} = 0.38$ . They guess that two compensating effects could explain our finding that  $G_{\text{Br}^-} = 2.77$  did not change in going from 0.2 M to 1 M methanol<sup>1</sup>, and overlook that we have experimentally verified that this cannot be so, because it was shown that 0.2–1 M methanol does not scavenge any H atoms<sup>2</sup>. An additional point is that our assignment of  $G_{\text{H}} = 0.17$  is calculated from the (constant) difference between  $G_{\text{Br}^-} = 2.77$  and  $G_{\text{Br}^-} = 2.60$  as measured for the same concentration region of methanol and isopropanol, respectively<sup>2</sup>. Thus, isopropanol and methanol react at similar rates with OH radicals, showing that interference with spur-reactions is expected to be similar for these scavengers, and that any "errors" from these reactions in the yields 2.77 and 2.60 are likely to be cancelled in the difference between these yields. The importance of the spur reaction  $\text{H} + \text{OH}$  will be discussed elsewhere. As to the accuracy of the yield  $G_{\text{H}} = 0.17 \pm 0.01$ , it should be observed that the measurements of the yields of  $\text{Br}^-$  are reproducible within  $\pm 2\%$ <sup>8,9</sup>, giving in our case a standard mean deviation in  $G_{\text{H}}$  of 0.01. Although not explicitly stated in our short communication<sup>2</sup>, we observe no change in  $G_{\text{H}}$  with decreasing  $\text{pH} < 7$  (to be published). In fact, the constant  $G_{\text{H}}$  yield at  $\text{pH} < 7$  is, as detailed elsewhere (manuscript in preparation), further evidence that  $e_{aq}^- + \text{H}_3\text{O}_{aq}^+$  does not yield H atoms and that the residual hydrogen is composed of two species.

In conclusion, there is at present no evidence that would contradict the contents of our previous work, which is confirmed by our recent work (manuscript in preparation).

M. K. is a fellow of the Norwegian Cancer Society.

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Received April 25, 1972.

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## Soft Phonon Modes and the Propagation Velocity of Martensite

THE interpretation of martensitic phase transformations remains a central problem in physical metallurgy. Studies of lattice properties such as elastic and anelastic behaviour, thermal expansion and thermal conductivity have resulted in