S 66. *On the Catalytic Properties of Element* 84 (*Polonium* 210).

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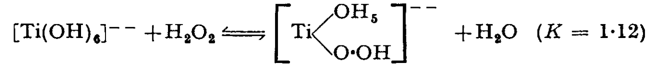
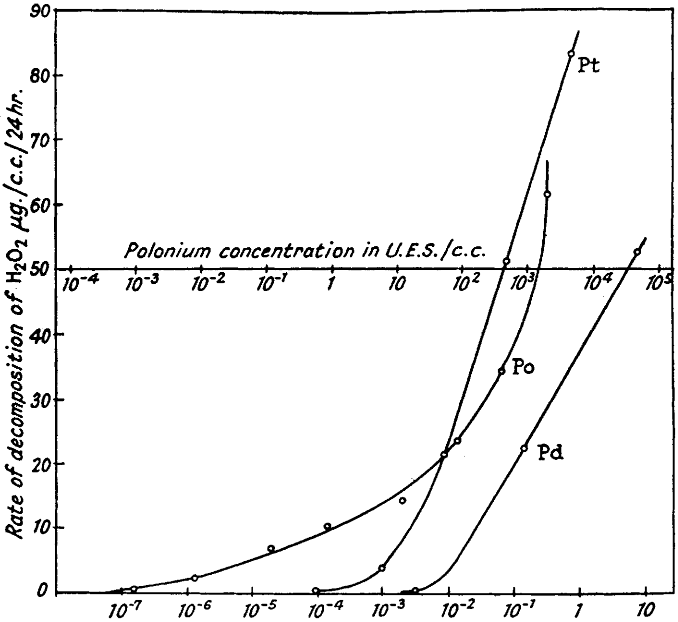
In the course of research on the decomposition of water by α-rays of polonium, we have obtained evidence of a curious catalytic action of this element. When the ionising radiations act on an acid solution of titanic sulphate, hydrogen peroxide is formed which combines quantitatively with the titanic sulphate to give a yellow substance probably according to the equation



$$[Ti(OH)_6]^{--} + H_2O_2 \rightleftharpoons \left[Ti\begin{matrix}OH_5\\O{\cdot}OH\end{matrix}\right]^{--} + H_2O \quad (K = 1{\cdot}12)$$

(Yellow.)

With *X*-rays the coloration is independent of ionic linear density (*i.e.*, of the wave-length of the radiation) and is a function only of the number of ion pairs formed in the solution. The coloration which is obtained in this way is very stable and permits a precise photocolorimetric determination of the absorbed energy (Bonet-Maury and Frilley, *Compt. rend.*, 1944, **218**, 127). In the ca the α-rays obtained from radon dissolved in the titanic solution, the coloration is likewise ction of the number of ion pairs formed, whereas dissolved polonium does not produce any coloration at the same ionic concentration. Investigation of this surprising, but regularly reproducible, phenomenon yielded the following information.



(1) If the α-rays are permitted to penetrate the solution but the polonium atoms are prevented from entering it, a normal coloration of the reagents and an ionic yield of the same order as obtained for α-particles from radon are found. This may be done either by placing a source of polonium on nickel or silver foil above the surface of the titanic solution or by covering the source with a thin layer of shellac through which an important fraction of the α-radiation (65—80%) can penetrate and immersing this in the solution. The first method does not permit a satisfactory calculation of the absorbed energy even with favourable geometric conditions. With the second method we can determine the energy crossing the shellac directly in an ionisation chamber. However, the shellac ultimately tends to crack, thus allowing increased amounts of polonium to pass into the solution so that long experiments are not feasible.

(2) The titanic solution which has already been coloured by α-radiation can be decolorised by addition of small quantities of an acid solution of polonium. This effect is independent of the anion used. Since one would have expected the α-radiation from the polonium to augment the initial coloration, it is clear that the polonium itself must be exerting a catalytic effect.

In order to obtain more precise results we have examined the influence of polonium and of the classical catalysts, such as manganese dioxide, silver, palladium, and platinum, on the rate of decomposition of hydrogen peroxide.* The results (see Figure) permit of a comparison of the catalytic action of polonium with that of platinum, the most active of the normal catalysts. The polonium shows for a rate of decomposition between 20 and 60 μg./c.c. an activity only slightly inferior to that of platinum. However, the range of the catalytic activity of polonium is much wider; *e.g.*, whilst platinum shows no detectable action at 5 × 10^{-4}μg./c.c., polonium has a feeble but clearly observable effect down to 10^{-7}μg./c.c..

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