sensitive to light was not at all affected. With the same exceptions, the effect was obtained only after partial drying, but appeared to be destroyed by complete calcination. Some of the substances did not always respond, even when taken from the same bottles as portions that did. None were chemically pure.

It seems possible that the phenomenon is due to chemical reactions with the active nitrogen, or it may be due to the presence of free electrons. An insulated electrode was sealed into the exhaust tube about a metre from the discharge tube and connected with an electroscope. When the latter was negatively charged little effect was produced by a stream of active nitrogen just past the stage of luminosity. When it was positively charged, it was rapidly discharged. When an uncondensed discharge was used with the same nitrogen, or the condensed discharge through inactive nitrogen, little effect was produced in either case. Recombination was apparently complete before the gas reached the electrode. As there must have been equal numbers of positive and negative ions, the loss of the positive charge must have been due to the greater mobility of the negative ions, and presumably they were free electrons. An attempt to measure the specific ionic velocities of the ions failed, on account of the electrostatic disturbances due to the disruptive discharge.

Under the conditions of these experiments, the line spectrum of nitrogen was not given by the light in the discharge tube. This indicates that molecular dissociation was small. The ions were probably for the most part molecular ions and electrons. The isolated bands in the first group which are the most characteristic feature of the spectrum of the active nitrogen afterglow must, of course, be due to molecular radiators. The afterglow depends upon the presence of a trace of oxygen (or some electronegative element) and is destroyed by the presence of more than a trace. It may be that in pure nitrogen there is no appreciable afterglow, because the great electron density favours rapid recombination. When there is an excess of oxygen, the electrons may all attach themselves to oxygen, and the final step may be the formation of nitric oxide, with the emission of Deslandres' third group of bands. If there is enough oxygen to remove most but not all of the electrons, recombination may go on slowly, the afterglow continuing while it lasts, the spectrum being due to the recombination of electrons with positive molecular ions. Of course the alternative is not excluded that active nitrogen may be monatomic and the characteristic radiation is emitted when it resumes its ordinary state.

<div style="text-align:right">E. P. Lewis.</div>

Department of Physics,
University of California.

Active Hydrogen by the Action of an Acid on a Metal.

Evidence for the formation of active hydrogen from its positive ion in an acid has been negative. The reports of the latest workers in this field, Wendt and Landauer (Jour. Amer. Chem. Soc. 42, 930 : 1920) show that there are certain difficulties to be met. The main one is to eliminate the moisture that accompanies a rapid evolution of hydrogen and at the same time not to destroy the active hydrogen if any were formed. If the velocity of the gas stream were too low, the active component would decay before reaching the sulphur. Then if the velocity were too high the moisture carried over would form a protecting film on the powdered sulphur and prevent the reaction between the two to form hydrogen sulphide.

During the work on the activation of hydrogen by corona discharge it was found by Wendt and Grubb (Jour. Amer. Chem. Soc. 42, 937 : 1920) that active hydrogen combines with pure nitrogen to give ammonia. This method of testing for active hydrogen can be used to good advantage where moisture is carried along with the evolved hydrogen, since the spray does not prevent the contact of active hydrogen and the nitrogen.

If hydrochloric acid or sulphuric acid is dropped upon metallic magnesium suspended in such a way that the metal is at no time immersed or partly covered with any large portion of liquid, the drop of acid can react with the metal in the shortest possible time. This gives off hydrogen very rapidly, in fact almost explosively, and with a minimum quantity of spray. If this evolved hydrogen is brought in contact with pure nitrogen it is found that ammonia is formed very readily. The active hydrogen was then passed through a plug of glass wool before coming in contact with the pure nitrogen. The activity of the hydrogen still persisted as shown by the formation of ammonia. Therefore, the activity of the hydrogen cannot be due to ions or atomic gas. But Langmuir (Jour. Amer. Chem. Soc. 34, 1324 (1912)) has shown that monatomic hydrogen does not react with nitrogen to form ammonia. In view of this fact, if we allow pure nitrogen to escape at the surface of the magnesium where the hydrogen is evolved we find a maximum quantity of ammonia formed. The amount of ammonia formed increases with an increase in the rate at which the acid is dropped upon the metal. This, of course, means that the amount of the active component varies with the velocity of the gas stream.

If the acid is dropped on the metal very slowly and the evolved hydrogen passed through glass wool before coming in contact with nitrogen, no ammonia is formed. This indicates that the active hydrogen has reverted to the ordinary form before meeting the stream of nitrogen. The life of the active gas seems to be not longer than two minutes. This checks very closely with the life of triatomic hydrogen formed by other methods.

These results seem to substantiate the theory of Wendt and Landauer (Jour. Amer. Chem. Soc. 44, 510 : 1922), namely, that triatomic hydrogen ought to be produced wherever atomic hydrogen is evolved. It is reasonable then to expect that a higher percentage of active hydrogen would be found in the gas evolved from the surface of the metal, than in the molecular hydrogen subject to electronic bombardment in a discharge tube. In the former all the hydrogen evolved goes through the atomic state, while in the latter case only a very small amount of atomic gas may exist at one time. The discharge would also destroy some of the active variety.

The preliminary results to determine the percentage of activation are in harmony with this theory. Further work is in progress to determine the quantitative relations of some of the factors involved.

<div style="text-align:right">A. C. Grubb.</div>

Department of Chemistry,
University of Saskatchewan,
Saskatoon, Sask., Canada, April 2.

The Viscosity of Liquids.

I wish very briefly to supplement the remarks made in a previous communication on this subject in which I have suggested that the viscosity of liquids and its variation with temperature may be explained on the hypothesis that the liquid state of aggregation is composite in character ; that is, is composed in part