

THE "FLASH" IN THE AFTERGLOW OF ARGON WITH A FIXED VACUUM

BY

CHARLES T. KNIPP

University of Illinois, Urbana, Illinois

In a recent number of the Philosophical Magazine the writer and L. E. Scheuerman described a "flash" that appeared in the afterglow of certain gases, notably nitrogen, when the residual gas was *suddenly compressed*. Recently (December 4, 1931) the writer while exhibiting the electrodeless discharge in a liter pyrex flask at the Butler meeting of the Indiana Academy of Science observed a flash in the afterglow with a *fixed* vacuum. This particular tube contained argon at a pressure of between 0.1 and 0.2 mm. of mercury, and was prepared in May, 1931. No record was kept of the moisture present, or of the purity of the gas. Mr. H. C. Roberts, assistant to the writer, said that this peculiar action of the gas was observed and briefly commented upon at the time the tube was sealed off, but for

some reason the phenomenon was passed by until the striking observation was again made as referred to above. A paper¹ recounting the above was read by title at the New Orleans meeting of the American Physical Society in December, 1931.

No definite experimental theory has as yet been attempted. The conditions for a flash are exceedingly difficult to obtain. Much time has been spent since the New Orleans meeting in attempts to prepare other flasks containing residual argon which would exhibit the flash but thus far all except one have proved unsuccessful. Argon from three different sources has been tried, and great care has been exercised in the moisture content and purity of the gas. Also much care has been taken in the outgassing of the pyrex bulbs previous to priming them with argon. To vary the conditions 12-liter and on down to 1-liter bulbs were employed. At no time was the slightest flash observed to accompany the afterglow. All this indicates that the optimum conditions for a flash are very critical. It seems that the inner surface condition of the flask is a factor, that impurities must be present in definite proportions and that the pressure of the residual gas must be exact. Possibly also the source of excitation must come within certain circuits. The liter bulb that seemingly works so well has failed on two or three occasions. The writer has taken this bulb with him on lecture trips and has failed twice to get results in seven or eight attempts. The source of energy was the 110 volt AC lighting circuit of the place visited. The failure was attributed to a possible low supply voltage at the time, since the exciting set-up was the same, of course, at each place. This is given as evidence that the conditions for producing the phenomenon are exceedingly critical and one is forced to conclude that the original bulb that does exhibit this flash is one possibly in a hundred.

Mention was made above of an exception. This was with residual air in a 12-liter bulb and was observed for a period of five to ten minutes only, when the condition for producing the flash was lost. We were not able to reproduce the flash though every effort was put forth to do so. In this instance it seemed decidedly to be a case of inner surface conditions and not the gas employed, for another 12-liter flask connected to the one in which the flash was observed exhibited no afterglow or flash, yet the same gas was in both and at the same pressure.

Thus we have but one bulb that exhibits this interesting phenomenon. The flash occurs within one or two seconds after the energizing source has been removed and is of sufficient brightness (when all goes well) to be observed by viewing it directly or by reflection on the walls of a darkened room. Following this the intensity of the afterglow changes color slightly and dies off rapidly. Some observers, who have viewed it critically, declare that additional flashes follow the initial one in decreasing brightness. This may be wholly subjective, the writer thus far has never observed any additional flashes.

Spectroscopic studies are planned. To date the energies of the writer have gone largely in the attempted preparation of additional flasks with the hope of intensifying the flash to better enable the spectroscopic studies to be made, but apparently with little success. This elusiveness makes the problem all the more fascinating.

¹ C. T. Knipp, Abstract No. 64, Phys. Rev., 39, 5, Mar. 1, 1932.