6-1926

A study of triboluminescence

George David Read
Union College - Schenectady, NY

A Study of triboluminescence

A thesis, presented to the Department of Chemistry of Union College, in partial fulfillment of the requirements for the Degree of Bachelor of Science in Chemistry by

George David Read UC 1926

approved by Charles B. Hurd III

May 28, 1926

A Study of Triboluminescence

Introduction

The study of triboluminescence, a phenomenon of no great practical value at the present time, is representative of a class of phenomena which scientists choose to call "cold light" and whose cause has for many years been without satisfactory explanation. Because of the fact that no use has been found for the action which brings about this production of light very little work has been done to determine, quantatively, any facts regarding it, and we have only a few theories which have been advanced without sufficient experimental data to prove any of them. Hence, this work was undertaken with only the hope of advancing another theory or of adding something to some of the theories already in existence.

Historical

In 1917 Imhof[1] did considerable work on triboluminescence and came to some very definite conclusions.

1 There is a minimum size to which all crystals may be brought for luminescence, this size varying inversely as the intensity of the luminescence.

2 Triboluminescence is afunction of the temperature except in the case of phosphorescent substances in which case it is independent of the temperature.

3 All double inorganic sulphates of Potassium and Ammonium and those of some other metals are triboluminescent, while all chlorides are non- triboluminescent.

4 About 47% of the triboluminescent substances give a blue color, 25% a yellow or orange color, while a very few give red and violet colors.

A few years later Longchambon[2] did some very interesting work on the triboluminescence of sugar in which he believed he had proved that the phenomenon

was due to a discharge of electricity between two particles of the substance suddenly separated.

More recently W. S. Andrews[3] has come to the conclusion that the above theory cannot be true. This will be mentioned later.

Apparatus

The material used in this work was a form of sugar (Necco Wafers) and the work was carried out in a dark room. The only apparatus used was a small motor whose speed was controlled by a rheostat. The motor was used to revolve a glass bottle in which the wafers were placed.

Results

It was found that triboluminescence could be obtained by causing a fracture of the wafer and, likewise, by rubbing the edges of two wafers over eacg other. To further carry out this idea several pieces of wafer were put into a bottle together with glass beads and the bottle rotated at such speed that the centrifugal force would not be sufficient to cause the pieces to remain at the surface of the bottle but rather the pieces would fall as the bottle turned, the glass beads causing the wafers to fracture in several places at once. These fractures would cause the bottle to become filled with a yellow colored light which could easily be seen in the dark room. It was olso found that when the edges of two pieces of wafer were rubbed together it was necessary that the force exerted upon them be a certain amount before they became triboluminescent and also that if too great a force were exerted the effect could not be obtained. The necessary apparatus was not avaliable to accurately measure this force but it was almost certain that the triboluminescent property of the wafer was dependent upon the force exerted, when the phenomenon was caused by the rubbing of two pieces of wafer together.