A taxonomy of deflagration related phenomena

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Deflagrations are a widely studied class of phenomena. These studies have many applications: pure science, engineering design, and safety are a few examples. From a philosophical standpoint, it has long been determined that proper definitions are important in the establishment of knowledge. Obtaining the definition of a scientific term can either come from known characteristics or by classification with related terms. As an example, the concept of momentum was developed over centuries, starting with generalities, and eventually incorporating conclusions from empirical studies. The case of deflagration follows a similar pathway. It is however not as advanced in its level of understanding. This paper attempts to first show the previous statement and concludes by proposing a taxonomy of related phenomena. The subject is put in the context of another application, safety, by showing the effect of an improper definition.

Given that many publications discuss deflagrations, it may seem unlikely that the term lacks a proper definition. A literature review has however shown that definitions given in journal articles and textbooks are not only differing, but sometimes in disagreement. These definitions were taken from publications on combustion physics, fire safety science, explosion safety and explosives applications. The motivation for this review resulted from attempting to produce training material on safety related aspects. Because the term deflagration is poorly defined, one may find it difficult to use it in characterizing specific situations. As an example, after viewing a video recording of some kind of combustion event, it can be difficult to characterize the event as a fire, a deflagration, or an explosion. Although seemingly trivial, this lack of precision can result in confusion and a subsequent decrease in safety.

Although poorly defined, deflagrations are part of a class of related phenomena. Many of these are more precisely defined. Examples of these related phenomena are fire, pyrolysis, decomposition, charring, combustion, explosion, detonation. It is therefore possible to generate a classification scheme of these terms starting from general chemical cases and going towards very specific situations. This can take the form of a classification tree. From this taxonomy, one can assign each level with specific theoretical and empirical evidence and proceed toward a more formal definition. In addition to helping progress towards a precise definition, the resulting classification tree is a useful graphical aid for training. The conclusions show that proper philosophical foundations are important in the evolution of knowledge. In this case, a widely studied and measured phenomenon that is not properly defined, which creates confusion that has ramifications on safety.

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