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Smouldering combustion is a type of combustion, which is ubiquitous in bushfires. Many forest biomass fuels such as grass, leaves and coarse woody debris are prone to smoulder. Smouldering combustion plays important roles in many aspects of bushfires, including fire initiation, fire spread, fire rekindling, environmental impacts, and ecological impact. In order to better understand smouldering combustion in bushfires, it is important to know what the requirements for the initiation of smouldering combustion are; how to identify the initiation of smouldering; and what factors affect the initiation of smouldering. In the first year of my studies, the focus of the research has been on determining the basic requirements for smouldering combustion, such as heating rate, air flow rate, oxygen availability and fuel. Hence, an experimental apparatus has been designed and built. The overall purpose of this testing apparatus is to initiate smouldering combustion in a reactor using radiant heat flux.

My initial application suggested that I would develop a new model for the initiation of smouldering combustion. Now, my research has focused on developing simplified analytical models based on the existing models, which may be subsequently incorporated into more elaborate bushfire modelling efforts. In addition to this, one of the initial research objectives is to investigate the effects of fuel types and properties on the initiation of smouldering combustion. Based on the literature review, the decomposition effect on the initiation of smouldering combustion may be investigated in the future.

Though this year some exploratory experiments were carried out. The exploratory experiments include three main activities: (1) the initiation of smouldering combustion at ambient temperatures; (2) the indication of smouldering combustion via mass-loss; and (3) the initiation of smouldering by radiation. The first experiment was aimed at initiating smouldering combustion in biomass in an elevated ambient temperature. The second experiment is to indicate the initiation of smouldering combustion using the mass-loss profile. The last experiment is to initiate the smouldering combustion using radiation.

The aims of the preliminary experiments are to initiate the smouldering combustion using the experimental apparatus and indicate the initiation of smouldering combustion in biomass fuel. Thereby enabling me to examine the research gaps and compare the results with those reported previously in the literature. In addition to the preliminary experiments, the capabilities of the experimental apparatus and operational limits are to be identified.

Smouldering combustion is an important element in bushfires; however, it has received less attention than flaming combustion on the research of bushfires. The outcomes of this research project will help better understand the initiation of smouldering combustion in biomass fuel, which could be beneficial in preventing, finding and controlling the initiation of smouldering combustion. Furthermore, the research project also helps land and fire managers understand the smouldering ignition in different types of Australian biomass fuel; which may be useful in preventing the occurrence of smouldering fire after prescribed fires.