Mathematical model for temperature and pressure change due to self-oxidation-reduction reaction of fuels in closed chamber

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If we put fuel and oxidizer in closed chamber and ignite, an oxygen atom which bonded with oxidizer obtail activation energy. Therefore, oxygen atom breaks the bonding with oxidizer and becomes free oxygen atom which can oxidizer fuel. Heat generated from the reaction activates another oxygen atom. As a consequence, oxidation-reduction reaction is repeated until whole fuels are burned out. By the self-oxidation-reduction reaction, exothermic reaction which release heat, light and gas, etc. occurs and fuels rapidly burned. Because this phenomenon could be occurred under anaerobic conditions, it is applying to gunpowder combustion of spacecraft and rocket needed to propel under anaerobic conditions. Due to growing interest in domestic aerospace industry, it is necessary to develop gunpowder combustion model in order to apply to various research such as gunpowder performance evaluation and aging study, etc. This study investigated such self-oxidation-reduction reaction problem by using energy balance equation considering heat loss from the closed chamber to the surroundings. After obtaining temperature change as a function of time, pressure change was also obtained using various equations of state.