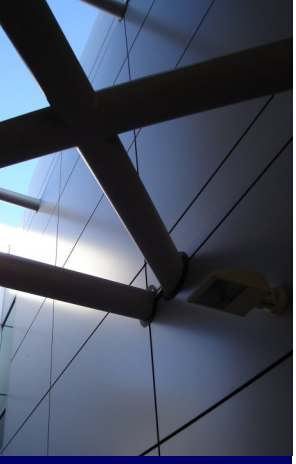

MECHANICAL ENGINEERING
DISSERTATION DEFENSE

The Department of Mechanical Engineering presents:

The Master's Dissertation Defense of

Salvador Antunez

Wednesday, December 13, 2017, 9:00 AM in Bourns Hall A265

Ignition Capability of Mechanically Generated Sparks Landing in Fuel Beds

Master of Science, Graduate Program in Mechanical Engineering
University of California, Riverside, December 2017
Dr. Marko Princevac, Chairperson

Experiments were conducted to examine the ignition capability of mechanically generated sparks to ignite organic matter after being produced through grinding. The experiments were performed using three different type of common metals which consisted of stainless steel, copper, and cold rolled steel. The grinding of these materials generated hot particles/sparks that were deflected downwards into a collection box containing organic matter. The organic matter consisted of the following types: weeping lovegrass, wild oats, timothy grass and cheat grass. For the first set of the experiments, the interaction between the metals and the fuels at different temperatures was studied. It was found that cold rolled steel and stainless-steel particles possessed the highest ignition capabilities. For the second set of experiments, the fuel moisture was varied considerably (20% - 80%) and it was determined that cold rolled steel particles could considerably ignite the fuels at decently high fuel moisture percentages. For the last set of experiments, the distance between the fuel bed and grinder was varied to match that of real-life applications. It was concluded that cold rolled steel could ignite these fuels beds up to distances of 100 cm (standing distance). Metal particles were collected and examined that cold rolled and stainless steel ranged from 0.0625 mm to 0.80 mm in diameter and were considerably smaller than that of copper which ranged from 0.4375 mm to 2.5 mm. Physical process concludes that cold rolled steel and stainless steel acquire higher initial temperatures than those of copper due to drastic difference in the toughness of the material. Both cold rolled and stainless steel are tougher metals; thus, a lot more separation energy is absorbed by the material before fracture. On the other hand, copper is a much more ductile material and absorbs less separation energy. The difference in separation energy dictates the initial temperature of the particles; thus, increasing the probability of particle combustion. For combustion to occur, the surface temperature of the particle must exceed the oxides melting point. This is supported by the microscopic images acquired of the metal particles. These results were used to assess the ignition capability of all three metals.