Piezoelectric sparker

(Ireland)

Background

The piezoelectric sparker is a rewired BBQ lighter connected to a film cannister, in which there is a single drop of methanol is combusted to demonstrate the activation energy (E_{act}) of an exothermic reaction.

The demonstration and construction instructions are courtesy of Mr. John Daly and can be found at the link: bit.ly/SonS2019

You will need:

- ✓ Piezoelectric sparker (adapted BBQ lighter – see link)
- ✓ Pasteur pipette
- ✓ Methanol
- ✓ Timer
- ✓ Ear protectors

Follow these steps:

1. Open the film canister lid, and Show the students the end of the flex, and that the sparker is working.
2. Set a timer for 30 seconds (timing varies from person to person, as our body heat is individual, so you will need to practice this).
3. Before demonstrating explain to students that a loud noise will happen and demonstrate how they can cover their ears with their hands (sound exceeds 85 dB).
4. Students should be a minimum of 3 m from the sparker.
5. Place the ear defenders on your head.
6. Using the Pasteur pipette add only one drop of methanol to the film cannister. Start the timer simultaneously.
7. Close the cannister lid, and wrap the palm of your hand around it, for 30 seconds.
8. Give students a countdown during the last 5 seconds.
9. Point the sparker at a target/blank wall.
10. Just before ignition unwrap you hand form the cannister and hold the flex 3cm from the cannister lid.
11. Ignite!

So what happened?

The warmth of your hand caused the methanol to vapourise and mix with the air contained in the cannister. The small amount of energy provided by the spark from the piezoelectric trigger allows rapid combustion (explosion) of the fuel air mix.

The combustion depends not just on the vaporisation of methanol but the relative pressures of the methanol vapour and of air. This is why the timing for vaporistion is variable, as the amount of heat radiated from a persons palm is individual.

Also too much methanol may not vaporise sufficiently for combustion.

So what happened?

In addition to demonstrating E_{act} of methanol it is possible

- to examine the chemical equation for methanol combustion
- to use the sparker as a simplified model of an internal petrol combustion engine (LC Chemistry)
- to highlight the power of a natural gas leak explosion in a home if a single drop can cause the effect students witness.