Sweet Spark May Hold Clue to How Things Break

By KENNETH CHANG

The Wint-O-Green Life Saver Effect, known as triboluminescence.

Within a couple of centuries, other scholars realized this was great fodder for practical jokes.

In 1733, Father Giambattista Becaria wrote, "A Treatise Upon Artificial Electricity." In it, he noted, "You may, when in the dark, frighten simple people only by chewing lumps of sugar, and, in the meantime, keeping your mouth open, which will appear to them as if full of fire."

In general terms, scientists understand the how and why of triboluminescence. In some materials, including sugar and quartz crystals, electrons build up as the fracturing occurs, and chemical bonds break. The charge builds up requires an asymmetric crystal structure or the presence of impurities.

And then, just like a jolt of static electricity, the electrons jump to nitrogen or oxygen molecules in the air, which shed the excess energy by emitting light.

Wint-O-Green Life Savers are particularly well-suited for observing this effect, because the oil of wintergreen - methyl salicylate - that flavors them.

Usually most of the light emitted by fracturing sugar is in the ultraviolet, out of view of human eyes. But the methyl salicylate absorbs the ultraviolet light and re-emits the energy as blue-green light.

In the latest University of Illinois experiment, Dr. Sushil and Nathaniel C. Edding-saas, a graduate student, started with a test tube filled with a slurry of small sugar crystals and liquid paraffin.

A vibrating titanium rod immersed in the test tube generated ultrasound waves that created millions of tiny bubbles growing and collapsing in the paraffin 20,000 times a second.

The shock waves slammed the sugar crystals together, and with nitrogen or oxygen bubbling through the slurry, the resulting bursts of light were typically 100 times, sometimes 1,000 times, brighter than the usual triboluminescence.

The spectral fingerprints revealed the presence of carbon monoxide, carbon dioxide ions and other products of combustion. Further work will try to determine the chemical reactions occurring during triboluminescence.

"It's basic science," Dr. Sushil said, "I don't see any applications, really. It's one of those things that have a long and illustrious history."