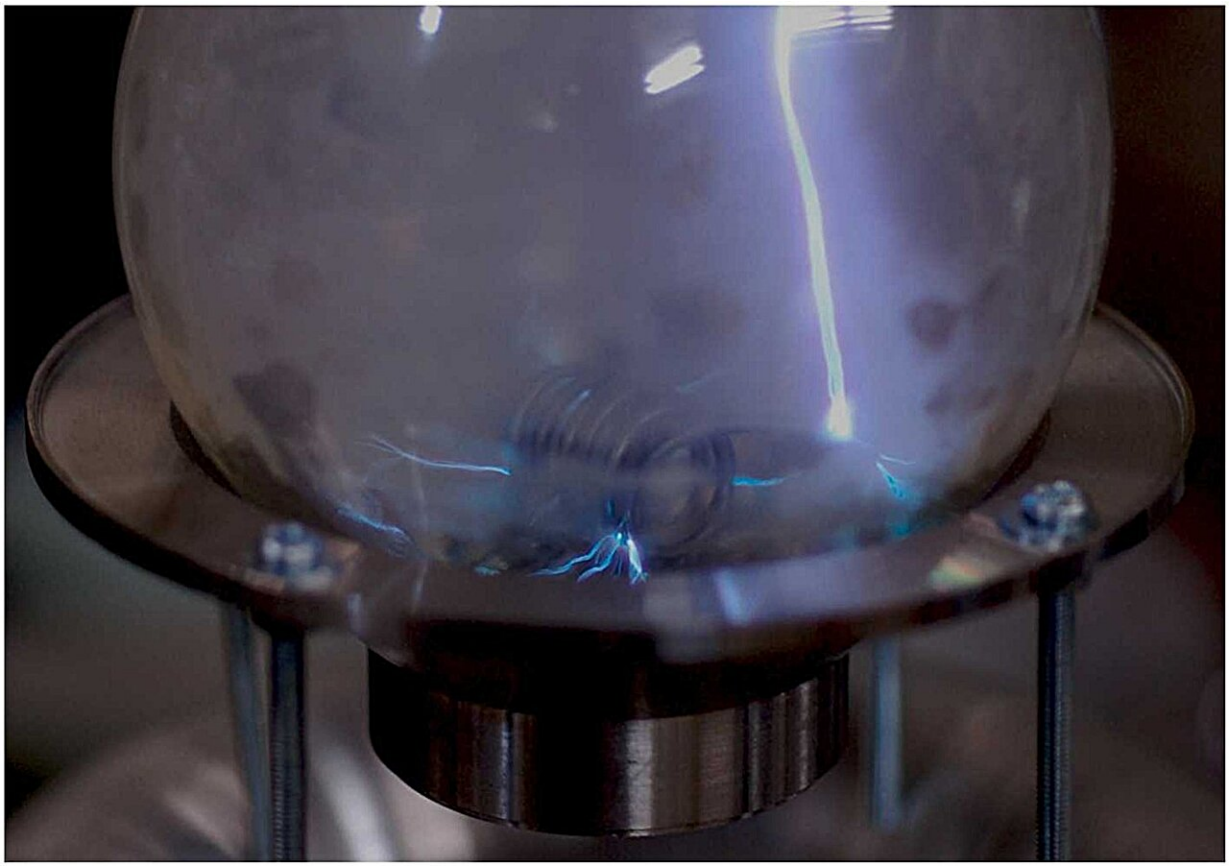
Innovative approach for synthesizing common plastics using remote spark discharge

August 5 2024



Graphical abstract. Credit: *Next Materials* (2024). DOI: 10.1016/j.nxmate.2024.100326

Researchers at University of Tsukuba have developed a unique technique for synthesizing commonly used polymers, such as polystyrene, using radical polymerization. Here, a remote spark discharge from a Tesla coil, which is a high-voltage, high-frequency generator allows the reaction to proceed without requiring conventional catalysts or polymerization initiators.

This new method provides considerable advancement in synthetic polymer chemistry. The study is published in the journal *Next Materials*.

Polymers such as polystyrene and acrylic resins are used in various plastic products, including food containers, packaging materials, and thermal cases. Traditionally, metal catalysts and radical polymerization initiators are used to synthesize these polymers.

This research team has previously developed several polymerization techniques for conductive polymers.

In their latest study, they introduced a novel method for polymer synthesis which involves generating monomer radicals through a remote spark discharge treatment using a Tesla coil, which is a high-voltage, high-frequency generator. These radicals then act as polymerization initiators.

The Tesla coil's capability to generate a powerful discharge without a counter electrode enables the spark discharge treatment to be conducted externally to the reaction vessel. Using this method, the researchers have successfully synthesized high-purity polystyrene and polymethyl methacrylate (acrylate), both extensively used in food containers.

Moreover, the team has discovered a new method for synthesizing polymers by applying a similar spark discharge treatment to conjugated polymers. They use the "soliton" generated by the treatment as an

initiator. This innovative approach is a first in synthetic polymer chemistry and opens new avenues for material synthesis using electromagnetic waves.

More information: Hiromasa Goto et al, Spark discharge-initiated radical polymerization, *Next Materials* (2024). DOI: 10.1016/j.nxmate.2024.100326

Provided by University of Tsukuba