# AI-Designed High Energy–Density High-Temperature Polymers

**Need for polymers with high dielectric breakdown strength at high temperatures**

The dielectric breakdown strength of a polymer is the maximum electric field that can be applied to it without destroying its insulating characteristics. This property, along with its dielectric constant sets an upper limit on the maximum electrostatic energy that can be stored in a capacitor. Such high energy density polymer dielectrics are favored in high-power, high-energy density capacitors. Recently, there is also a need for such polymers to function well at high temperatures. A world with increasingly demanding high-power electronics at high temperatures necessitates the development of polymers with breakdown strengths, dielectric constant and thermal stability that surpass the limits of commercially available materials.

**AI-designed high energy–density high-temperature polymers**

Innovators at Georgia Tech have developed new artificial intelligence algorithms which can be used to develop a new set of polymers that can potentially have ultra-high energy density at high temperatures. These algorithms use multi-task learning to identify multiple practical high-temperature options for synthesizing polymers. These algorithms use multi-task learning to identify multiple practical high-temperature polymers and corresponding synthetic pathways. Moreover, these algorithms are created such that they yield polymer recommendations that are easy to synthesize in the real world.

**Summary Bullets**

- The present materials are capable of withstanding enormous electric fields at very high temperatures.
- The materials produced are extremely lightweight.
- Vehicles making use of these materials will be lightweight, and lighter vehicles consume less energy.

Solution Advantages

- **Robust:** The present materials are capable of withstanding enormous electric fields at very high temperatures.
- **Lightweight:** The materials produced are extremely lightweight.

- **Environmentally friendly applications:** Vehicles making use of these materials will be lightweight, and lighter vehicles consume less energy.

Potential Commercial Applications

- Usage in hybrid and electric vehicles.
- Usage in pulsed electrical systems used for food preservation.
- Usage in medical defibrillators, power grid electrification, and pulsed power defense systems.

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**IP Status**

Patent application has been filed : US63/384261

**Publications**


polyG2G: A Novel Machine Learning Algorithm Applied to the Generative Design of Polymer Dielectrics, Chemistry of Materials - August 31, 2021


**Images**

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