

## **Hybrid Materials for Piezoelectric Energy Harvesting and Conversion**

### **Introduction to hybrid piezoelectric materials**

Dhlamini, Khanyisile S  
Council for Scientific and Industrial Research (CSIR)  
Meiring Naude Drive, Pretoria, 0184  
Email: SDhlamini@csir.co.za

In response to the global energy crisis and pollution resulting primarily from nonrenewable energy sources, researchers are exploring alternative energy machinery capable of harvesting energy under ambient environmental conditions. Piezoelectric energy harvesting is rapidly becoming a preferred technique for powering devices on a mesoscale to microscale. Piezoelectric materials can produce electricity as a result of mechanical stress; these materials can also exhibit the inverse piezoelectric effect, known as the converse effect. Certain materials possess piezoelectric properties, such as bone, proteins, crystals (quartz), and ceramics (lead zirconate titanate). The combination of piezoelectric materials with two or more other materials leads to the development of hybrid materials that have improved properties and can be applied to novel applications. With hybrid piezoelectric materials, existing technologies can be enhanced, and new devices and systems can be developed, ranging from healthcare, ultrasonic transducers, energy storage, smart fabrics, sensors and actuators, energy-harvesting systems, and robotics.