A Discrete Fe(II) Complex-Based Piezoelectric Nanogenerator for Self-Powered Wireless Morse Code Communication

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The rapid growth of IoT and wearable electronics has increased the demand for sustainable and self-powered technologies. Piezoelectric nanogenerators (PENGs) offer an attractive solution by converting mechanical energy into electricity; however, conventional inorganic piezoelectric materials often require high-temperature synthesis and may involve environmentally hazardous components. Here, we report a discrete Fe-based molecular ferroelectric, [Fe(TPMA)(2-pic)]$(ClO_4)_2$ (**1**), exhibiting promising ferroelectric and piezoelectric properties. Incorporation of **1** into a PMMA polymer matrix produced a flexible piezoelectric nanogenerator with an open-circuit voltage of 8.5 V and excellent sensitivity toward low mechanical stimuli. Leveraging these properties, the device was further developed as a self-powered Morse code generator capable of converting mechanical inputs into electrical signals for real-time Bluetooth-enabled wireless communication. This highlights the potential of molecular ferroelectrics for energy harvesting, self-powered sensing, human–machine interfaces, and emergency communication in next-generation flexible and autonomous electronics.

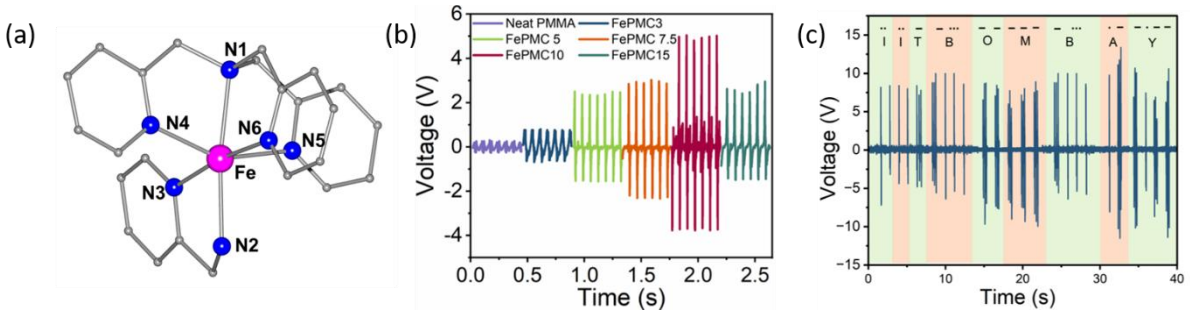

Figure 1: (a) Crystal structure of the molecular Fe (II) complex (b) Voltage vs Time response of Fe(II) complex integrated composite devices (c) electrical output generated through finger tapping according to a Morse code, denoting 'IIT BOMBAY'.

References:

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