NOVEL METHODS OF FUNCTIONALISING CEMENT FOR ENERGY HARVESTING FROM CONCRETE-BASED STRUCTURES

The principal vision for this project is to determine the fundamental science underpinning the functionalisation of Portland cements for pyroelectric energy harvesting from concrete-based structures such as aircraft shelters, ports, command posts and ammunition depots. Pyroelectric energy harvesting allows for the direct conversion of fluctuating ambient temperature into electricity.

COMPETITIVE ADVANTAGE

- Using this approach, an entire cement structure can be employed as a pyroelectric energy harvester
- The pyroelectric power is available 24/7
- The pyroelectric behaviour of the structure can be combined with its piezoelectric properties due to vibrational input, effectively establishing a hybrid pyro-piezoelectric energy harvester
- Pyroelectric energy harvesting is cheaper and more cost-effective than batteries, given that the basic ingredients are naturally occurring crystalline minerals

SUCCESSFUL APPLICATIONS OF RESEARCH

- Successful application of the research outcomes would enable the Australian Defence Force to more effectively conduct pervasive monitoring and control of its critical infrastructures (e.g. airports, aircraft shelter, naval bases/ports, command posts, ammunition depots) against physical security threats such as natural disasters (e.g. earthquakes, floods, storms), sabotage and terrorist attacks, technical failures due to human errors, design faults and interruptions to energy supply

PARTNERS

- Infratech Industries

IMPACT

- The outcomes of this research will enhance the Australian Defence Force's ability to deploy truly 'fit and forget' self-powered wireless autonomous devices, wireless autonomous sensor networks and low-power electronic devices to its critical infrastructures

CAPABILITIES AND FACILITIES

- Analytical instruments for measuring pyroelectric coefficient
- Instrument for measuring the dielectric constant of materials
- Analytical instruments such as X-ray powder diffraction (XRD), scanning electron microscope (SEM), nuclear magnetic resonance (NMR) spectroscopy, Brunauer–Emmett–Teller (BET) and mercury porosimetry for measuring morphological and structural properties of pyroelectric materials
- Pyroelectric energy harvesting cells

MORE INFORMATION

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