



University of  
**Strathclyde**  
Engineering

# THE FACULTY OF **ENGINEERING**

[www.strath.ac.uk/engineering](http://www.strath.ac.uk/engineering)

# THE AWARDS 2019

## WINNER UK UNIVERSITY OF THE YEAR FOR A SECOND TIME

Times Higher Education University of the Year 2012 & 2019  
Times Higher Education Widening Participation Initiative of the Year 2019  
The University of Strathclyde is rated a QS 5-star institution

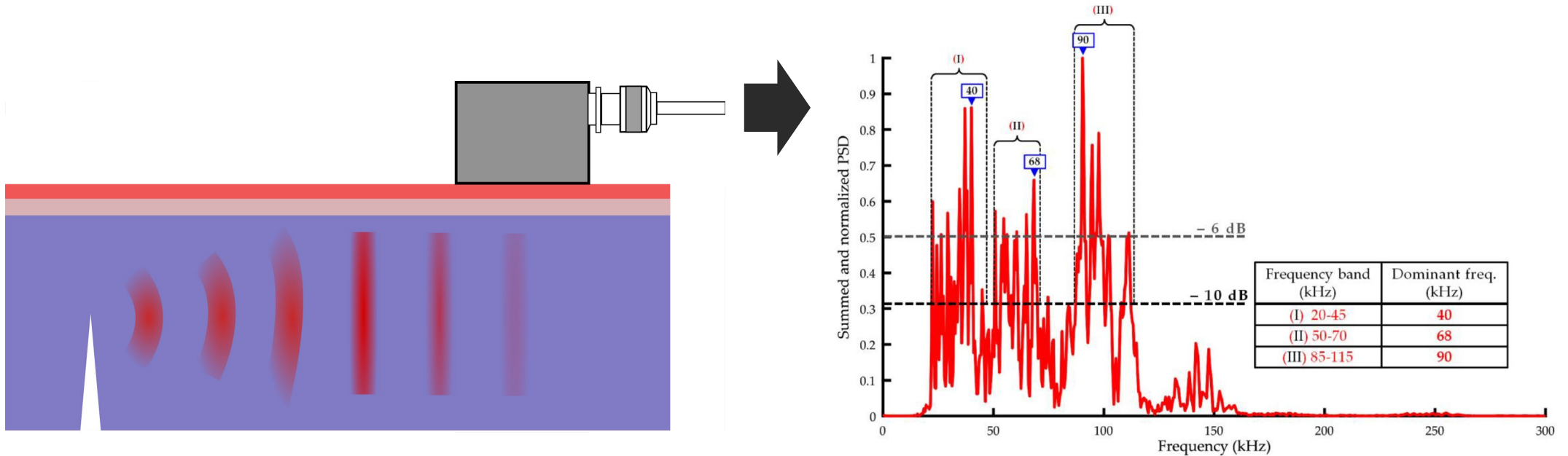


# NOVEL PIEZOELECTRIC COMPOSITES FOR PARTIAL DISCHARGE MONITORING

Dr Rolan Mansour, Dr Andrew Reid, Prof Brian Stewart, Prof James Windmill

# ACOUSTIC EMISSIONS DETECTION

- Partial discharges can occur across the voids, causing voltage stress and an acoustic impulse
- For a partial discharge, typical frequency range is low ultrasound up to 200 kHz

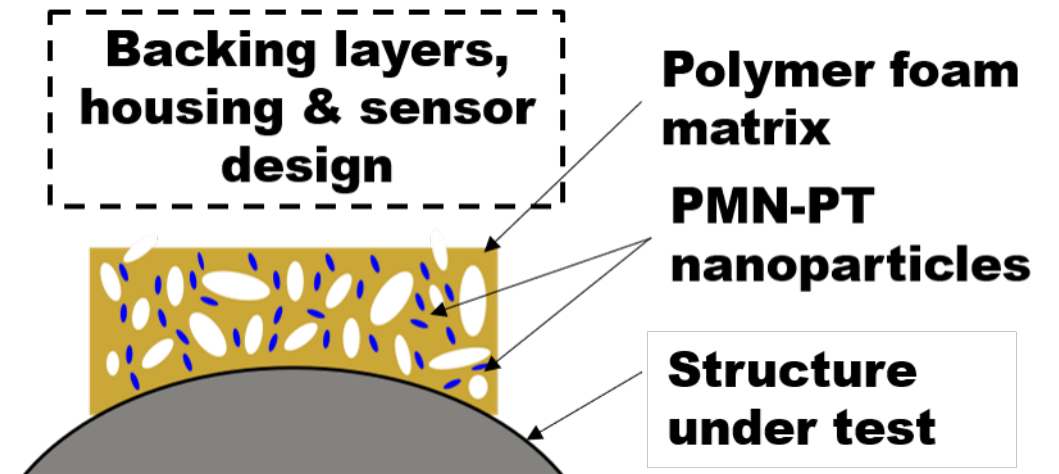


[1] Sikorski, Sensors (2019), 19(8) 1865

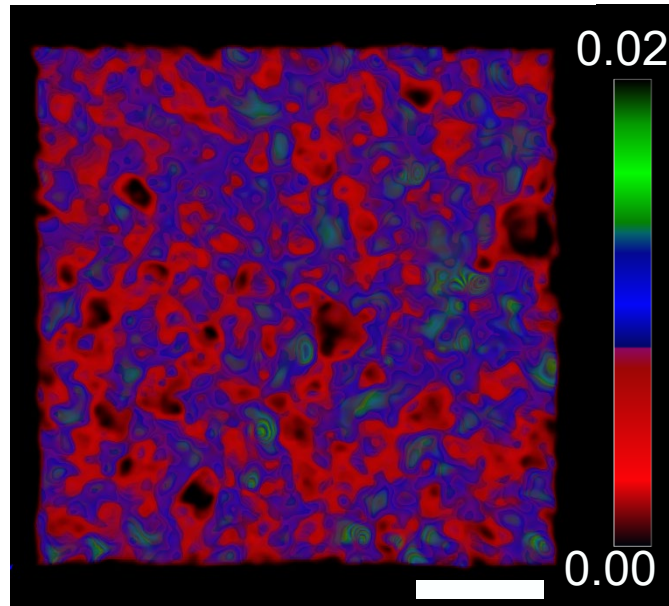


# NOVEL COMPOSITE SOFT SENSOR

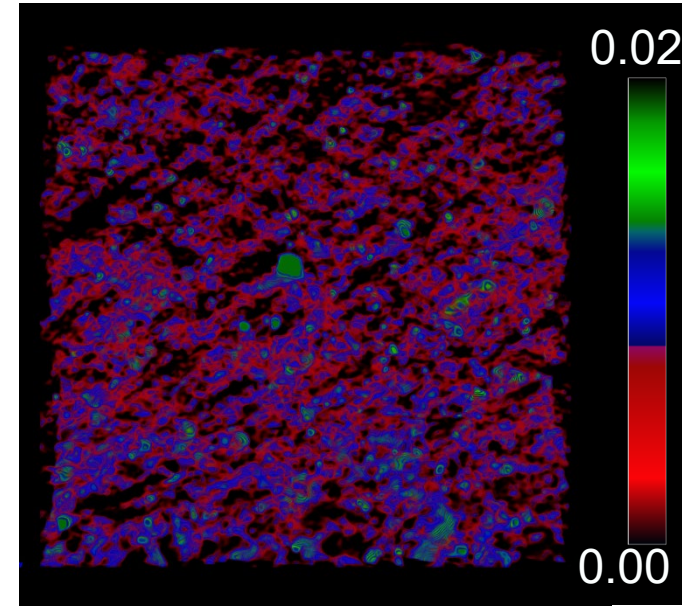
- Polymer composite of PMMA and PMN-PT remains highly flexible
- Photopolymerizable, can be made to fit any cable / pipe
- Significantly higher coupling co-efficient than PVDF.



# SUGAR CASTING



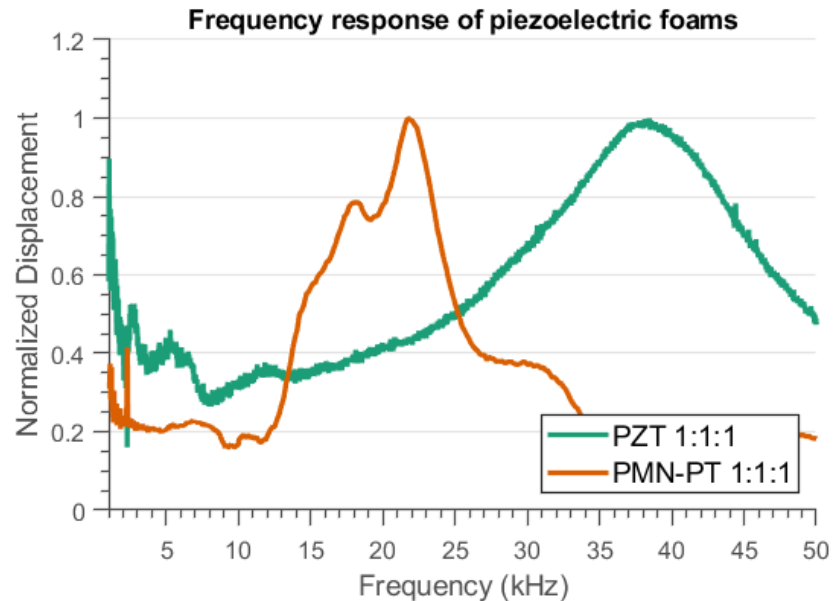
**Icing sugar / PMN-PT / PMMA**



**Boiled PMN-PT / PMMA**

- Sugar casting provided a simple entry point compatible with photopolymerization.

# GAIN IN COUPLING COEFFICIENTS



Polymer/ Piezo composite	d33 measurement	
	No voids	Sugar cast
PZT / FormLabs Grey	33 pm/V	33 pm/V
PMN-PT / FormLabs Grey	35 pm/V	69 pm/V



# University of **Strathclyde** Engineering