

Thermal, electrical, and sensing properties of composite material from environmental and industrial wastage

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ABSTRACT

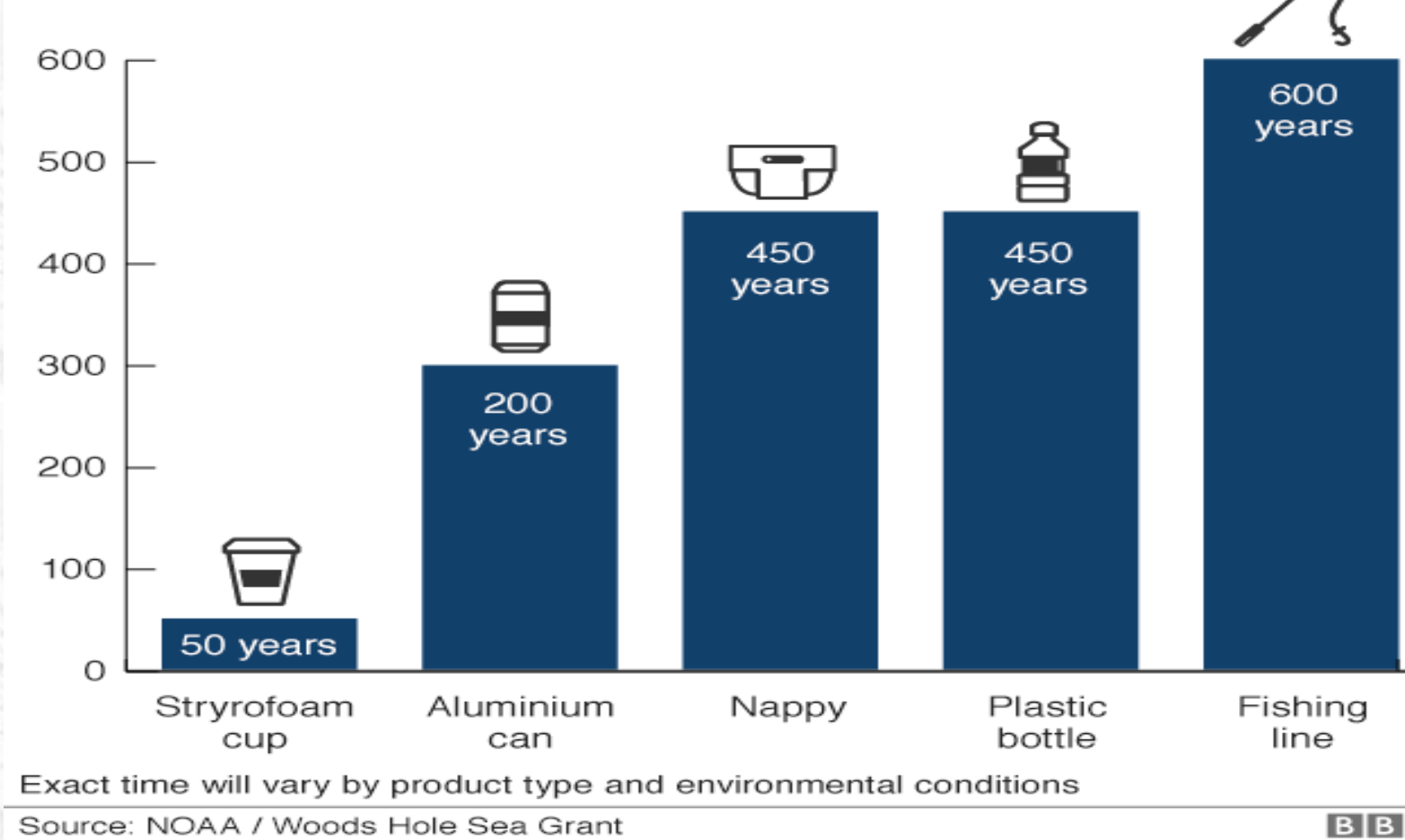
This work is an endeavour to contemplate a value-added conductive plastic composite material derived as recycled plastic depending on Polyethylene (PP)/carbon black. We choose to add Carbon black (CB) as a filler material in order to enhance the electrical conductivity as well as other properties associated with the composite. Solution mixing method was adopted to develop this composite where the consequences of CB loadings on various parameters like processability, morphology and thermal stability of the composites were examined. Electrical conductivity increased with the increasing amount of the CB loading. The clearly perceived better filler-matrix interaction and filler dispersion were observed in images obtained from Scanning Electron Microscope (SEM). These are the underlying reason behind the improved electrical, thermal, sensing and dielectric properties of the prepared plastic composite material.

INTRODUCTION

- Nowadays, plastic is the main material that people depend on worldwide.
- It is nearly used in every item that is manufactured in the world.
- However, misusing these materials could lead to serious environment issues.
- This table illustrates the waste per person that is being produced everyday in different countries.
- As a result, we need a solution to reduce this waste?????

How long til they're gone?

Estimated time taken to biodegrade



EXPERIMENTAL



Plastic waste



Waste from Qatar aluminium company (carbon black)



The plastic bottle (HPDE) was cut into small pieces and dissolve in solvent (Toluene)



Ultrasonication to disperse the carbon black in the solvent (toluene).



prepared composite in different wt% filler (carbon black)

Film fabrication



Ultrasonication (2 hrs) method to disperse the carbon black powder the solvent in a homogeneous way



The 24 hrs magnetic stirrer to disperse the plastic perfectly with the carbon black powder.

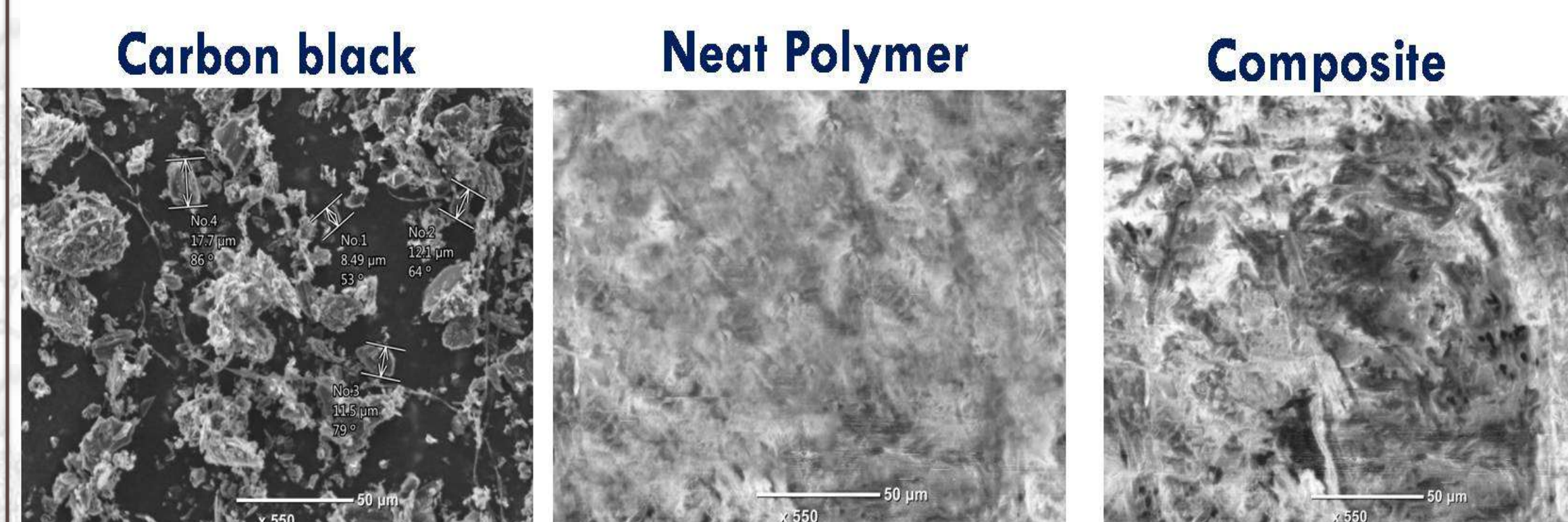


Prepared homogeneous solution was poured in a petri dish and dried for 24 hrs using vacuum oven

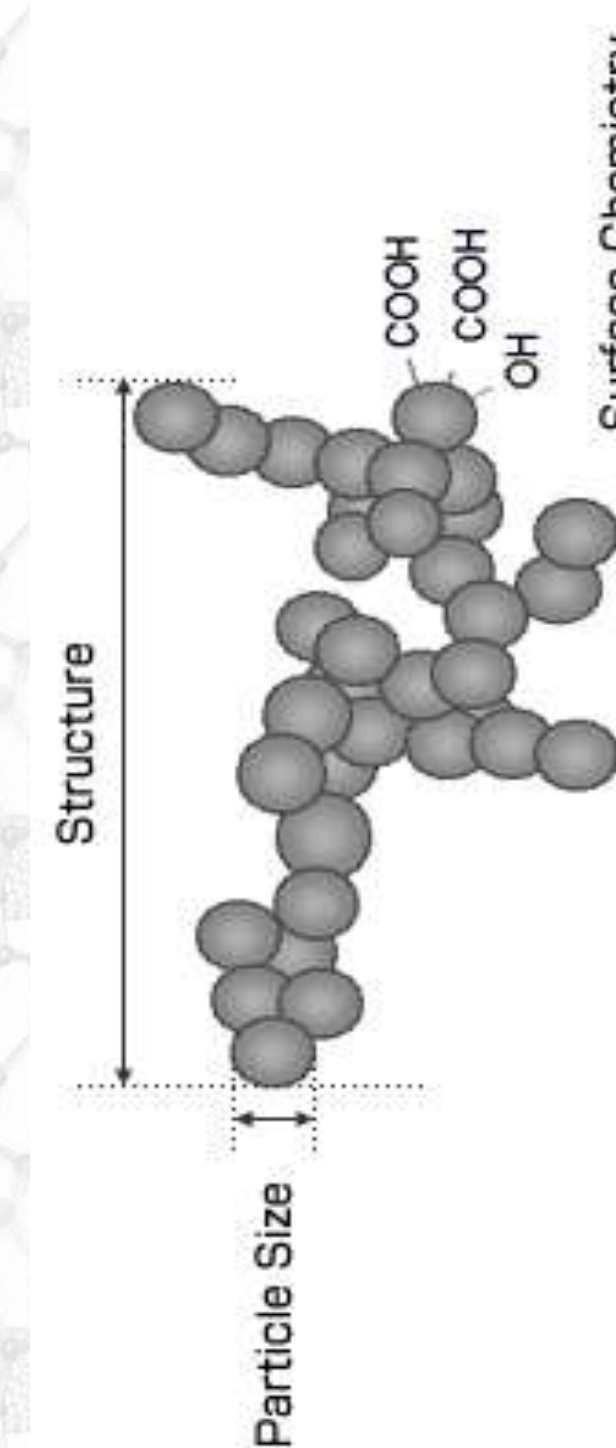
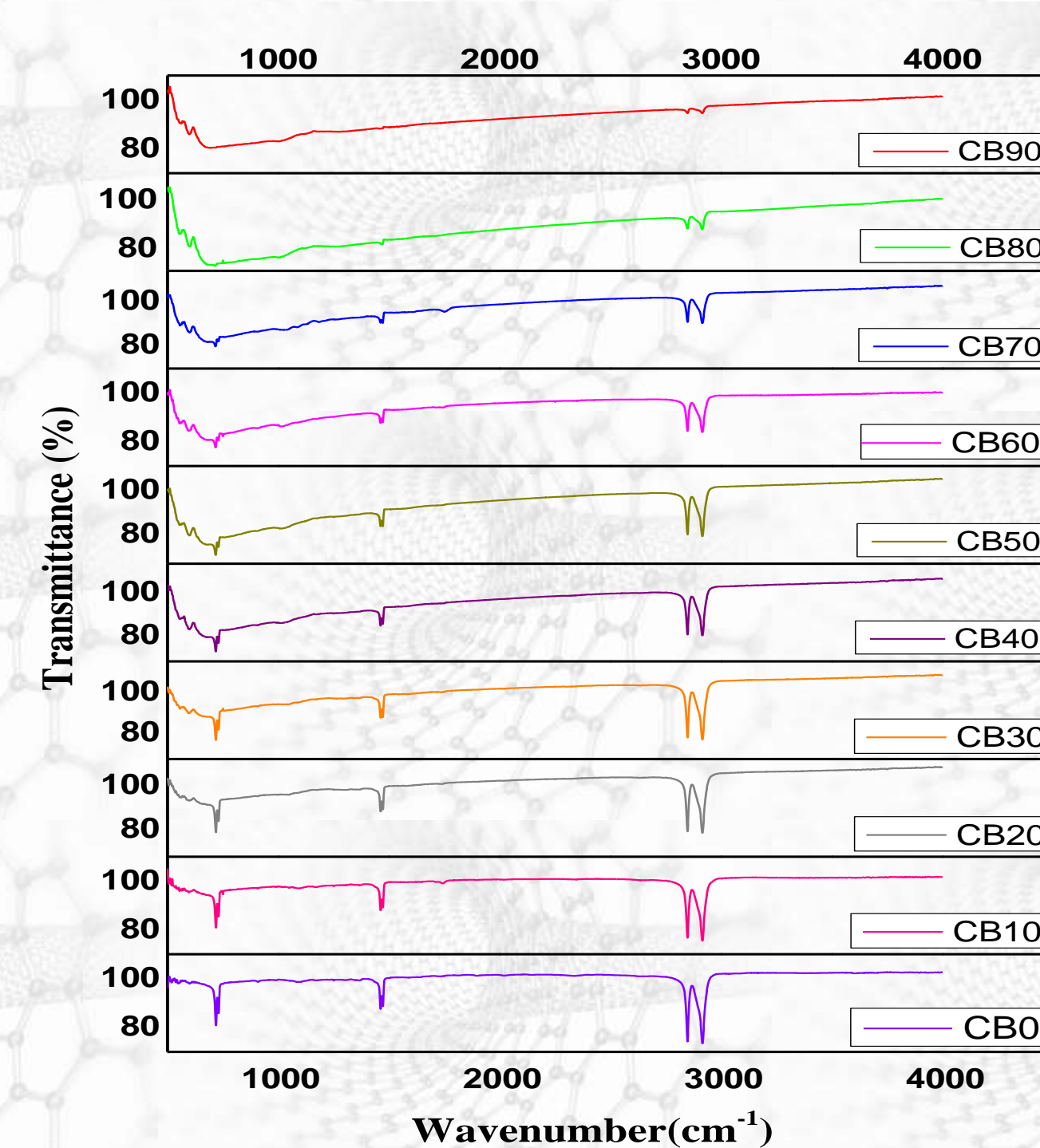
The final film was peeled off and cut in to the appropriate size.

RESULTS & DISCUSSION

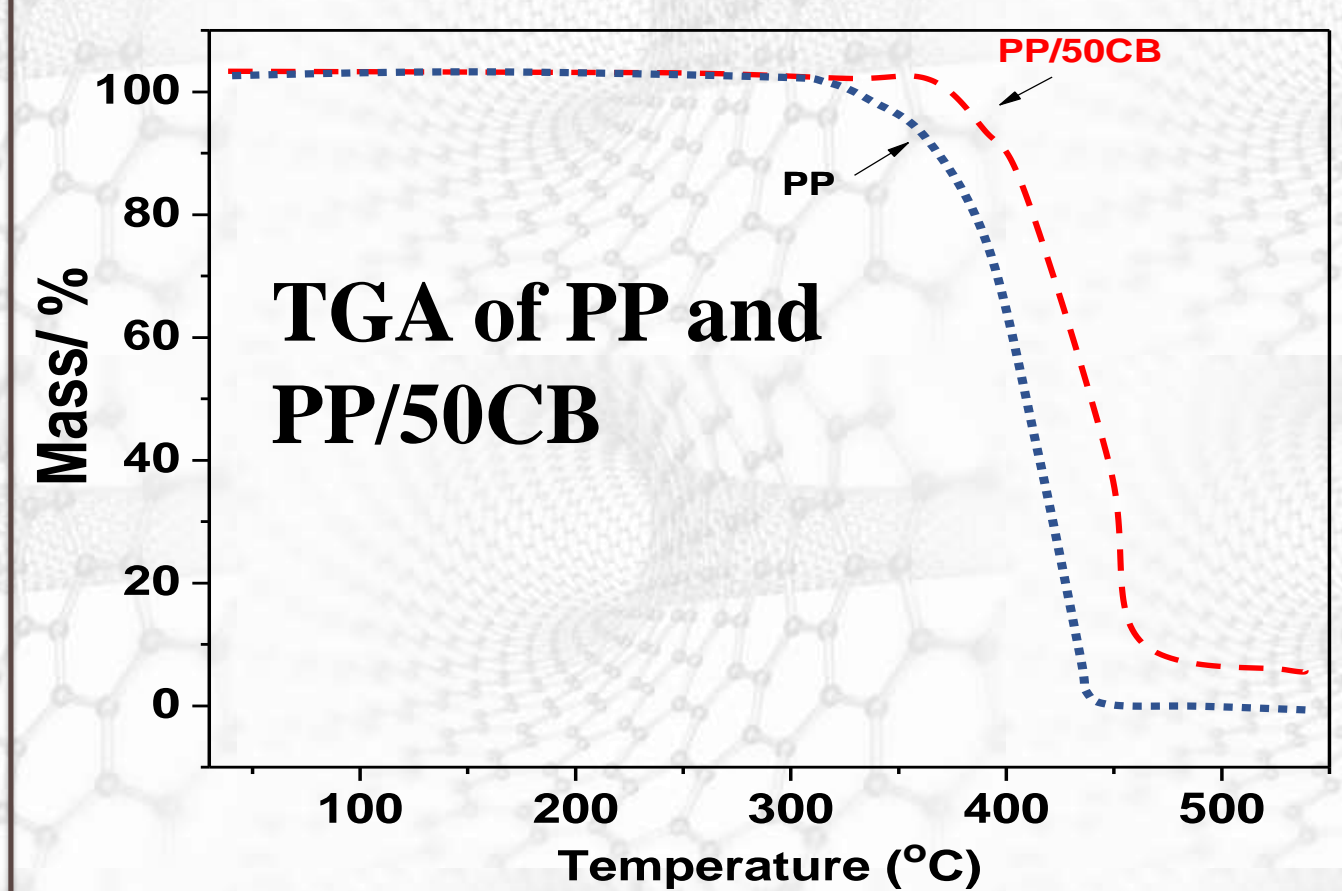
Morphological studies



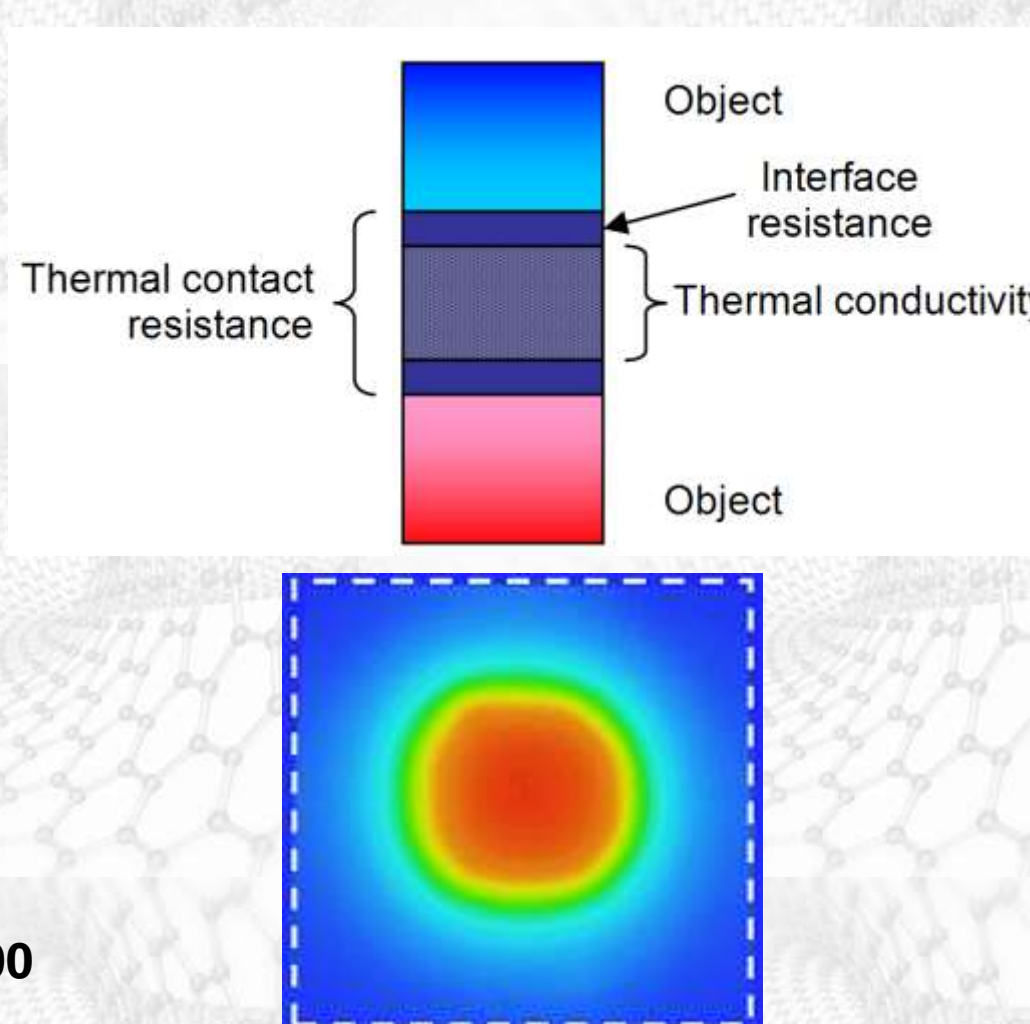
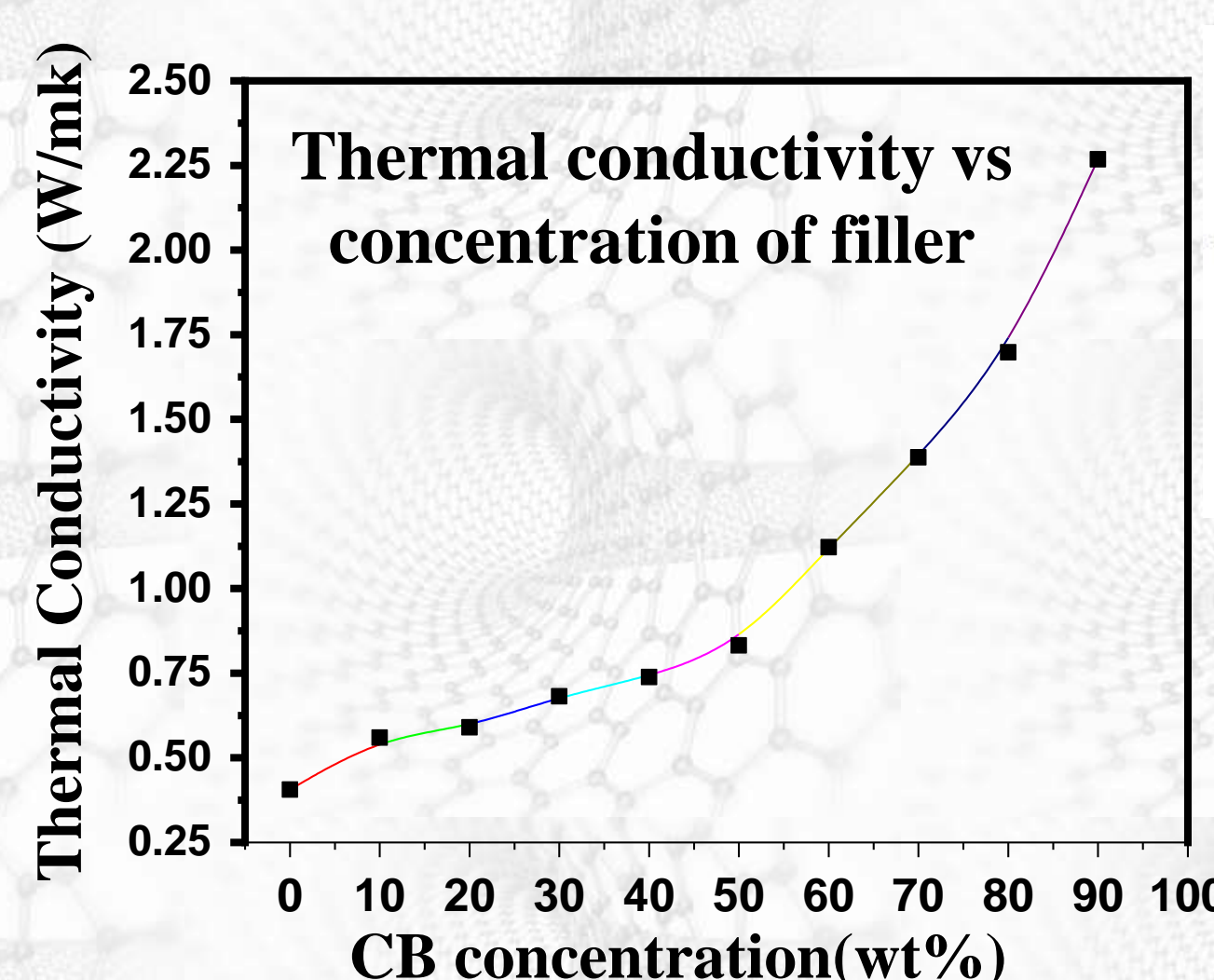
FTIR analysis



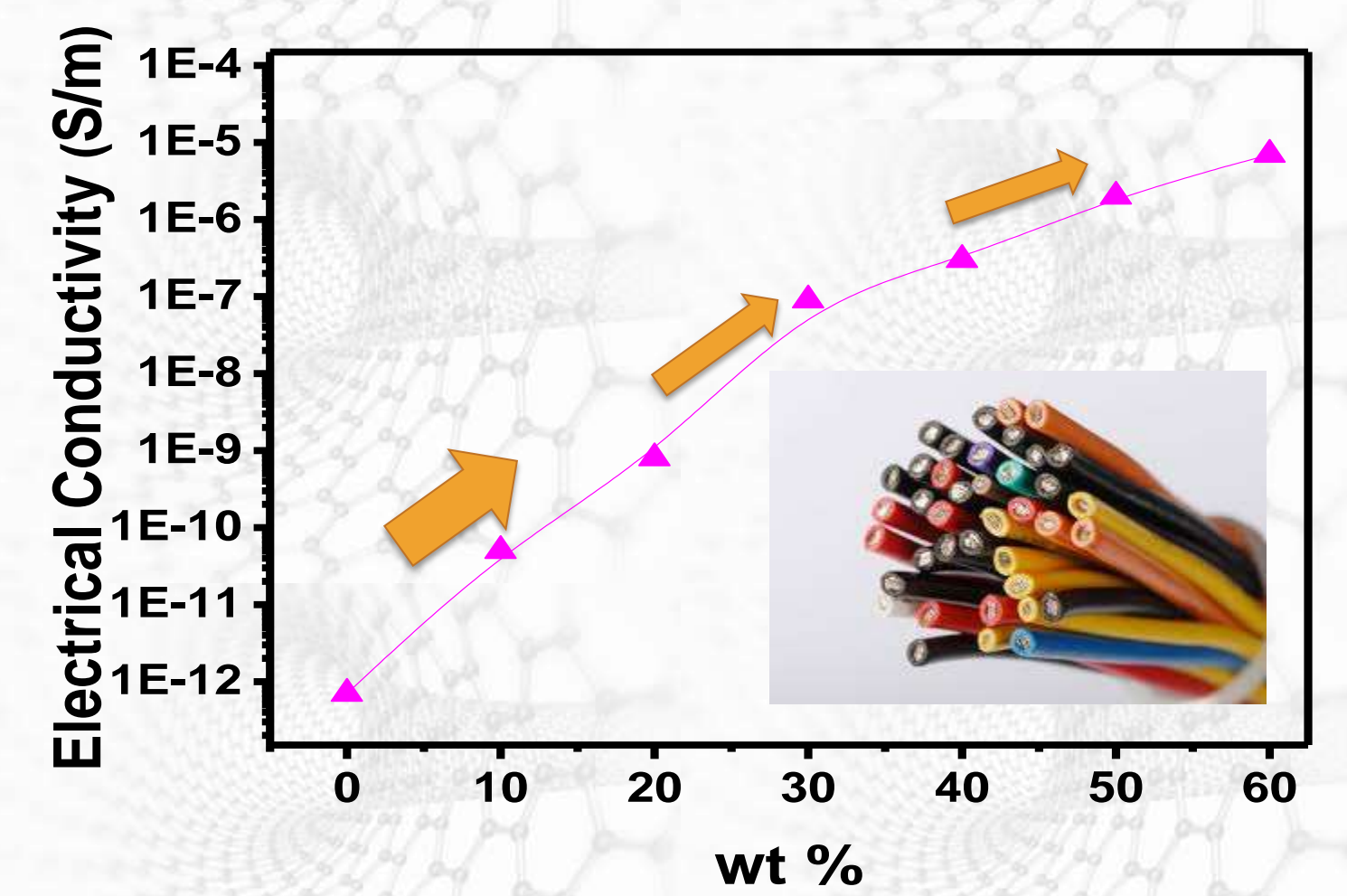
Thermal studies



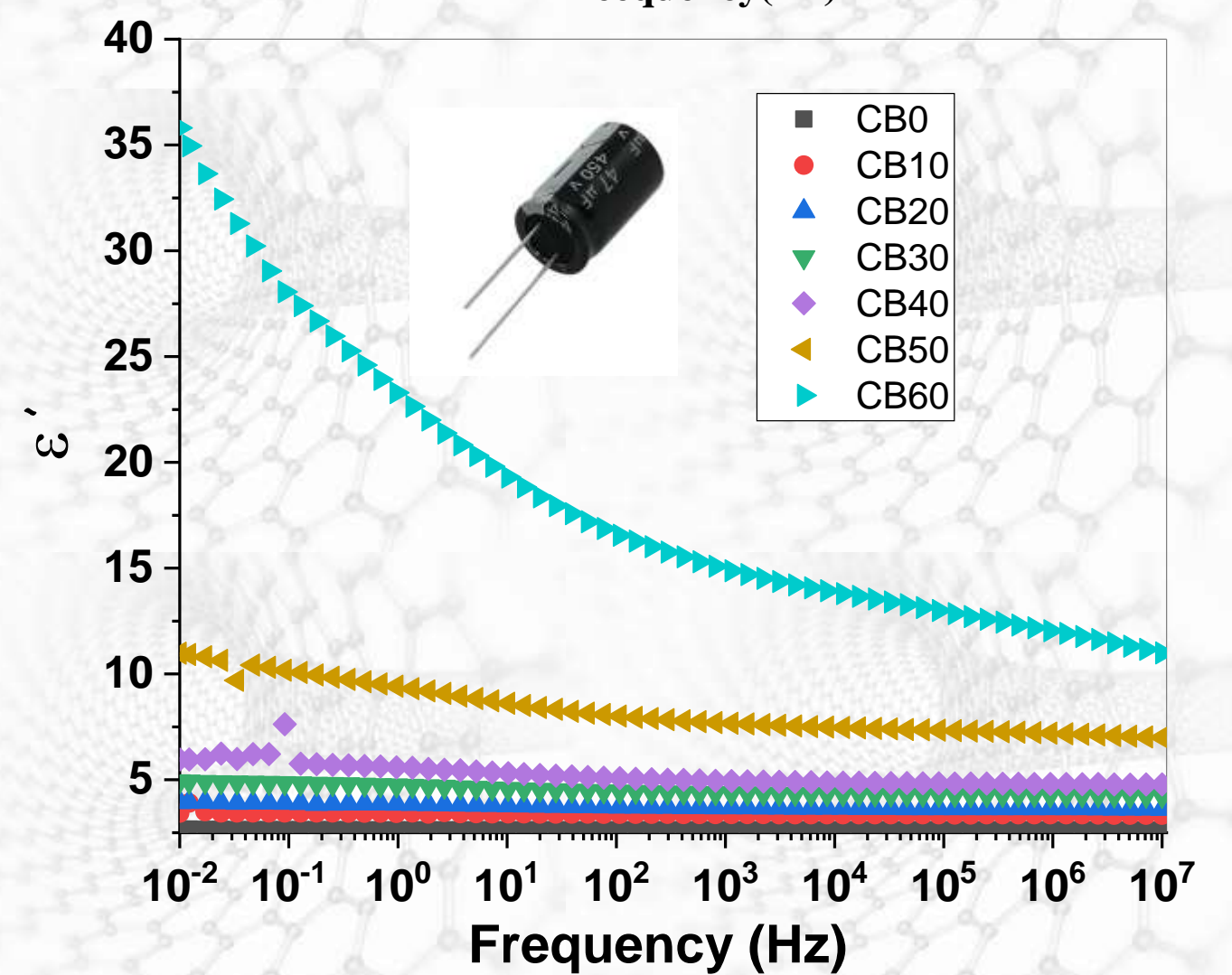
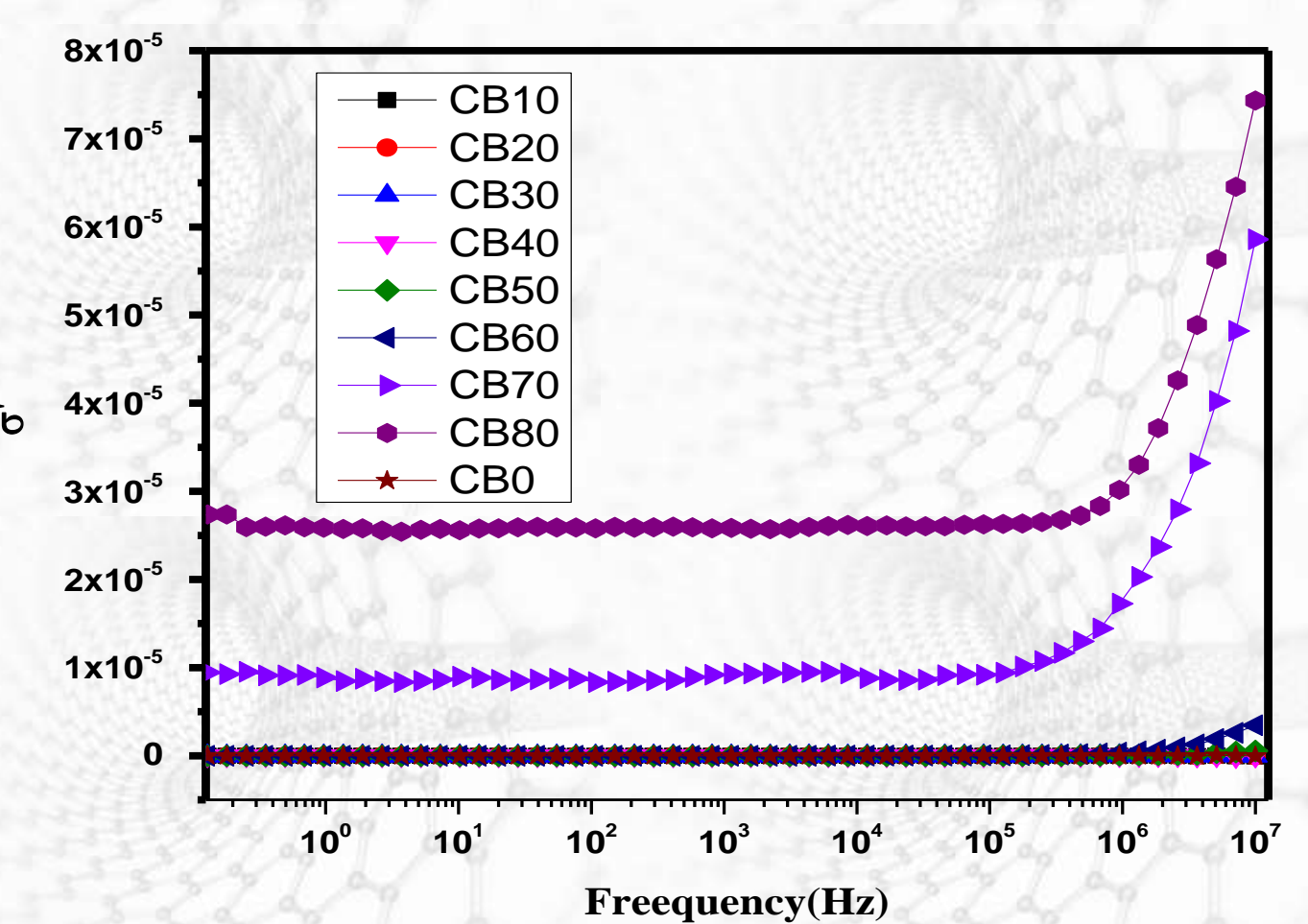
•TGA curves of CB filled PP/ blends and it represents upon loading the CB the thermal stability of the polymer improved significantly.
•This Figure gives a strong evident that the composite can with stand at high temperature around (380°C).



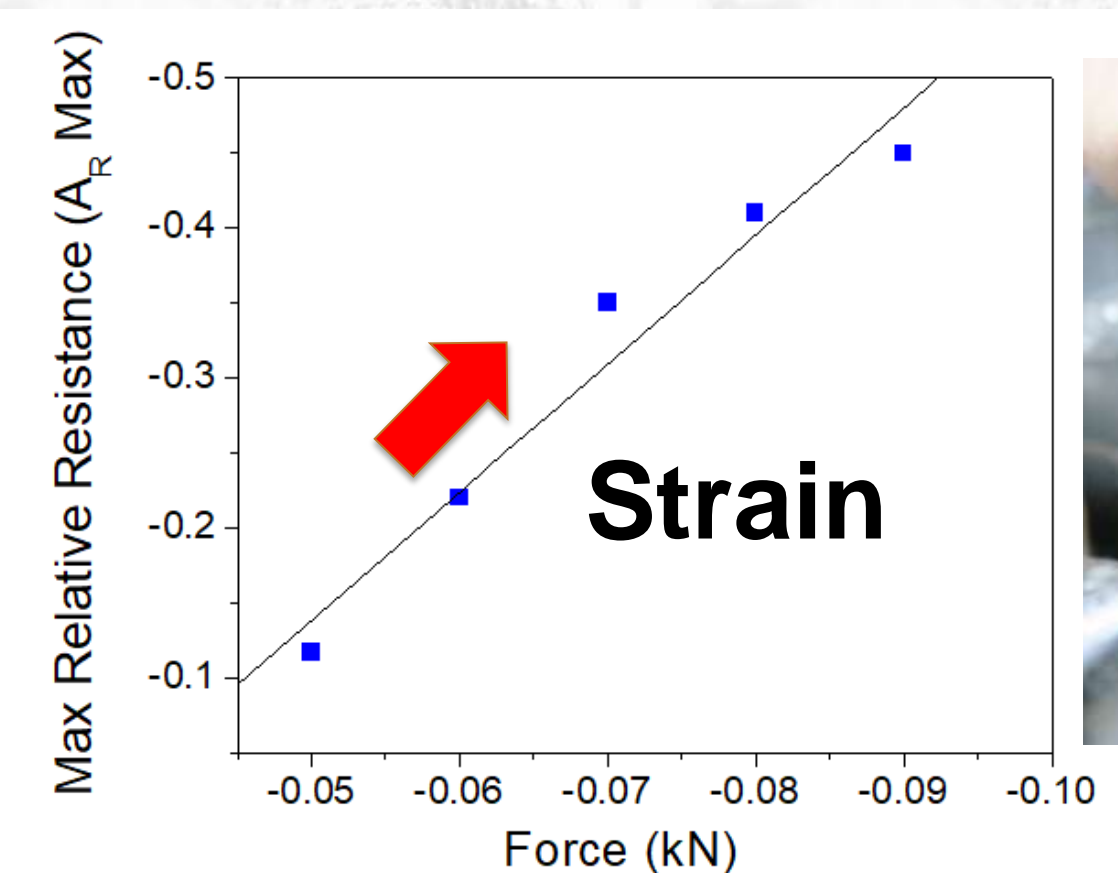
Electrical studies



Dielectric studies



Sensing studies



BENEFITS TO QATAR

The state of art technologies currently involved for separating the plastic wastes, processing, analyzing its properties and designing the value-added products have many associated issues, and at the same time the generated waste generation is not reducing effectively to great extents as needed. It is thus, significant to local research capacity in the strategic area of polymer waste recycling in a country especially like the one Qatar's where, economy is concerned.

CONCLUSION

- The carbon black particles are uniformly distributed within the composite matrix.
- Prepared plastic composite material exhibits thermal conductivity.
- Dielectric studies of the prepared plastic composite material exhibit high dielectric constant and useful in energy storage and sensing applications.

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- Wei, L. and Oxley, C. (2016). Carbon based resistive strain gauge sensor fabricated on titanium using micro-dispensing direct write technology. *Sensors and Actuators A: Physical*, 247, pp.389-392.