

Identification of Bio-chemical Contaminants in Composite Materials Based on Recycled PET Using Time-domain Terahertz Transmission Spectroscopy

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Polyethylene terephthalic acid - PET

- the main component of plastic packaging materials with around 70 million tons being manufactured every year;
- intensely used in a lot of applications, such as textiles, food and pharmaceutical industries;
- PET materials are single-used and are not degraded by microorganism \approx 359 million tons of plastics/year \rightarrow 150-200 million tons accumulate in natural habitats [1,2].

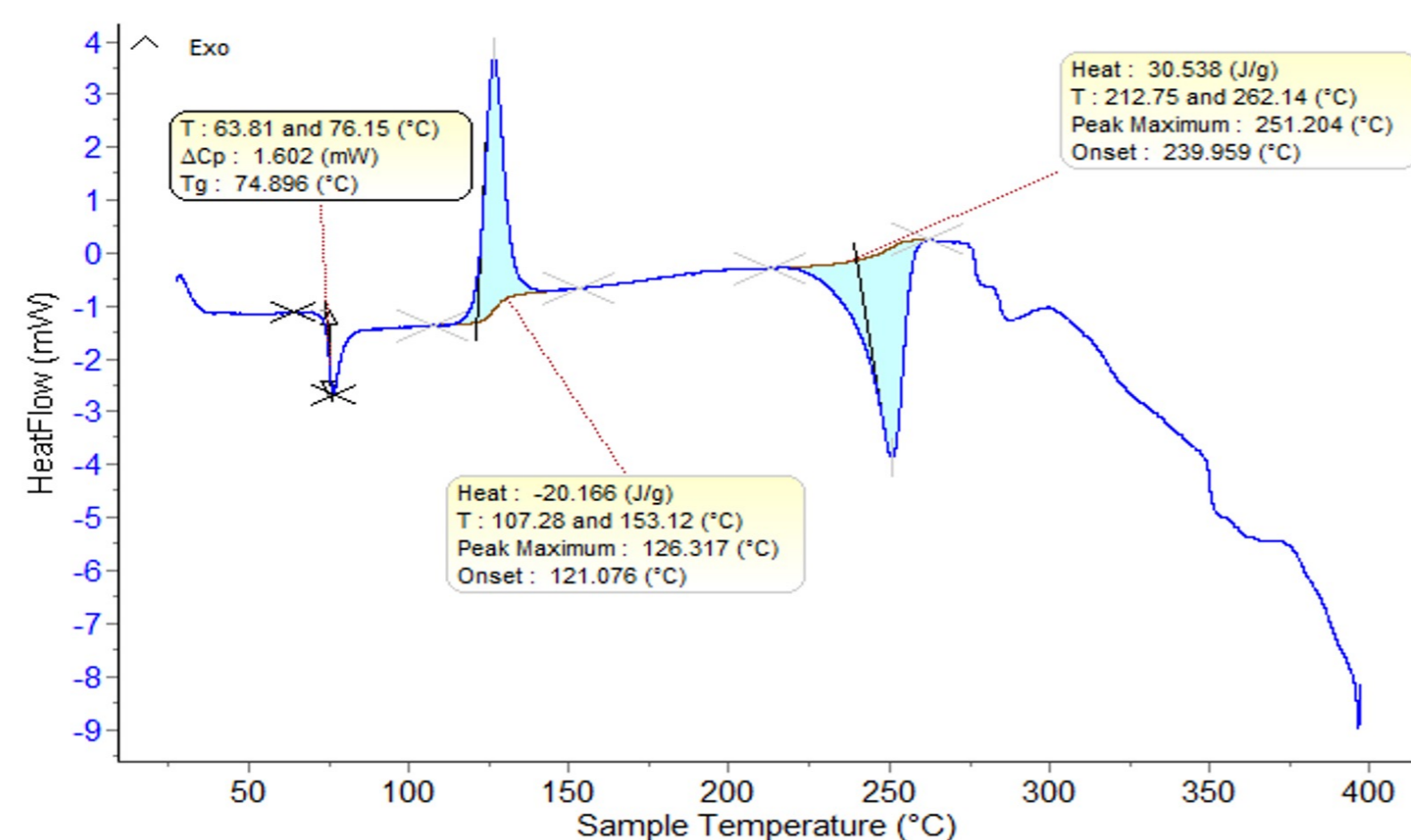
Secondary recycled PET

- no control over the waste PET source \rightarrow contain chemical and/or biological contaminants;
- > 175 potentially hazardous substances (alone or mixtures) are used in the production of food/pharmaceutics contact materials that can be transferred towards packing \rightarrow high risk factor for public health;
- no actual laboratory methodology focused on chemical and biological contaminants in packaging [3,4].

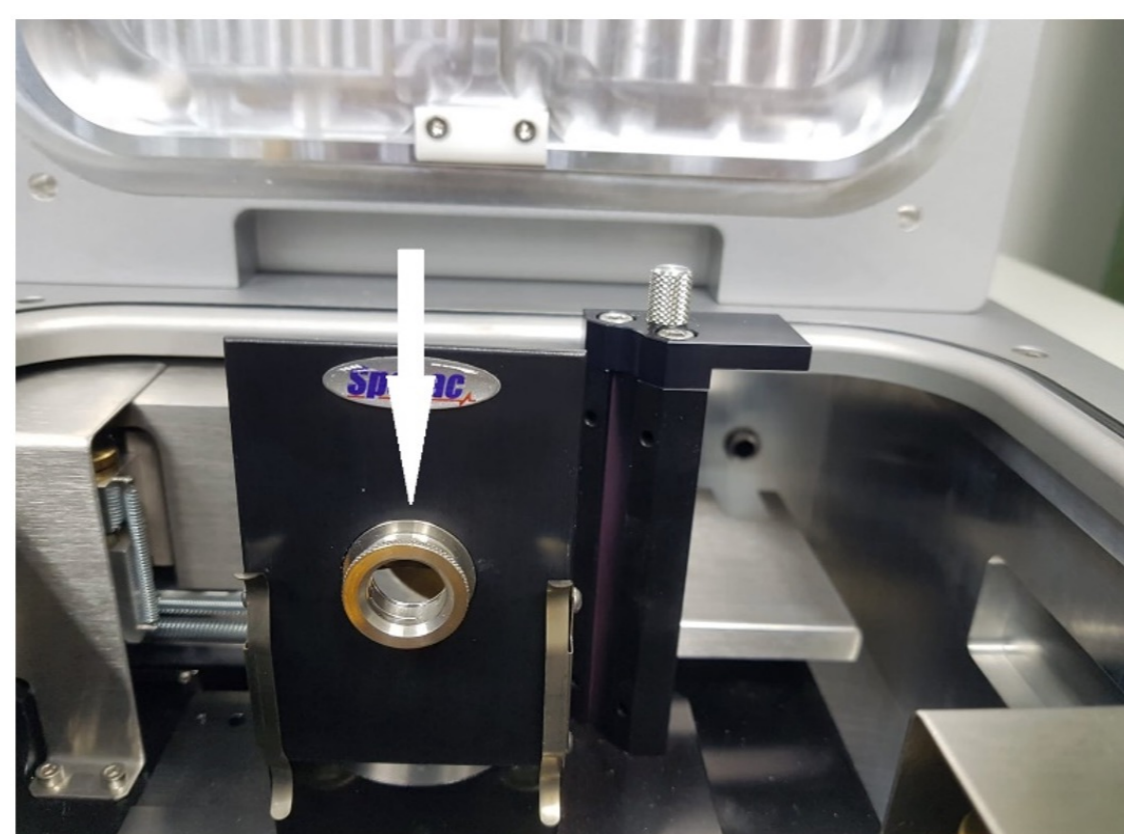
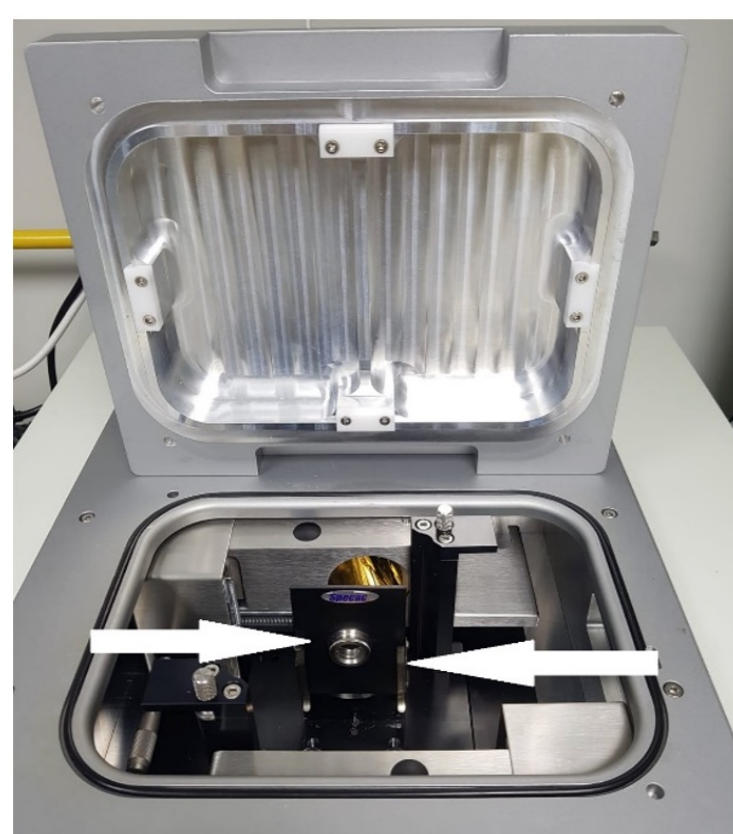
Time-domain terahertz transmission spectroscopy - TDTTS - an emerging technology that brings a number of technical breakthroughs in several scientific applications;

Experimental

An injection moulding machine (Dr. Boy Germany) has been used to obtain various composite materials based on different amounts of recycled PET, aluminum nanopowder and iron nanopowder. TDTTS has been used to analyze the simple materials and the contaminated materials (proteins solutions).



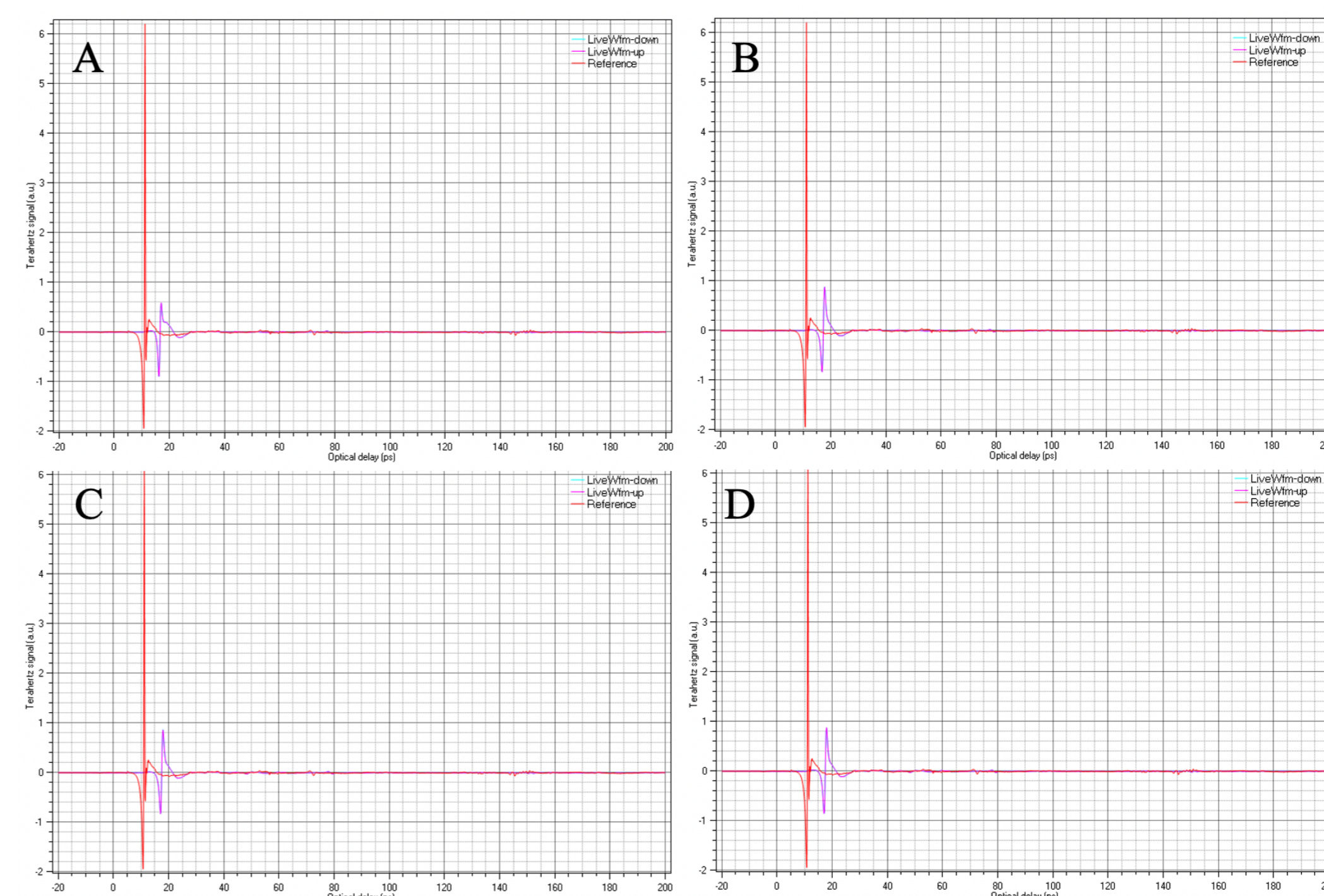
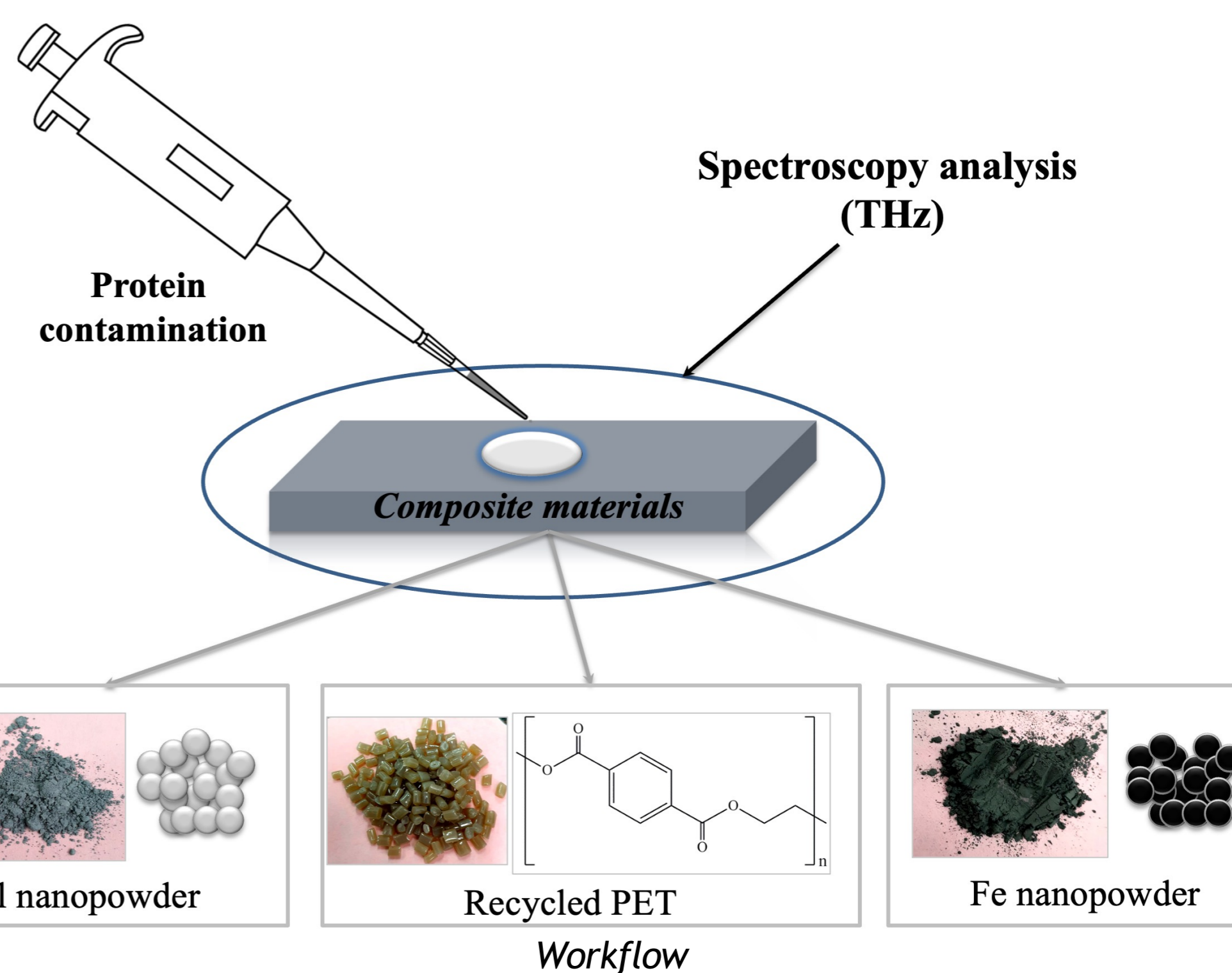
DSC spectrum of the used PET



Terapulse 4000 (TeraView) - TDTTS module

Conclusions

Comparing the spectra obtain for simple materials and contaminated ones a higher intensity has been observed in case of biological contamination, meaning that TDTTS is a promising technique for identification of potential biochemical contaminants on recycled PET.



(A) TDTTS spectrum of a raw composite material; TDTTS spectrum of contaminated composite material: (B) 1% Type I Collagen, (C) 1% BSA, (D) 2% BSA

Acknowledgements

This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI -UEFISCDI, project number PN-III-P2-2.1-PED-2019-3970, within PNCDI III.

References

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