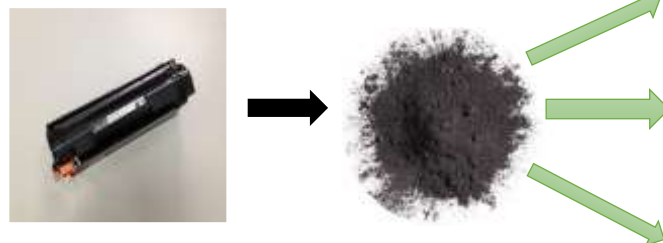


# WASTE-TO-WEALTH: FROM PRINTER TONER WASTE INTO VALUABLE MAGNETIC MATERIALS

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## Product Background

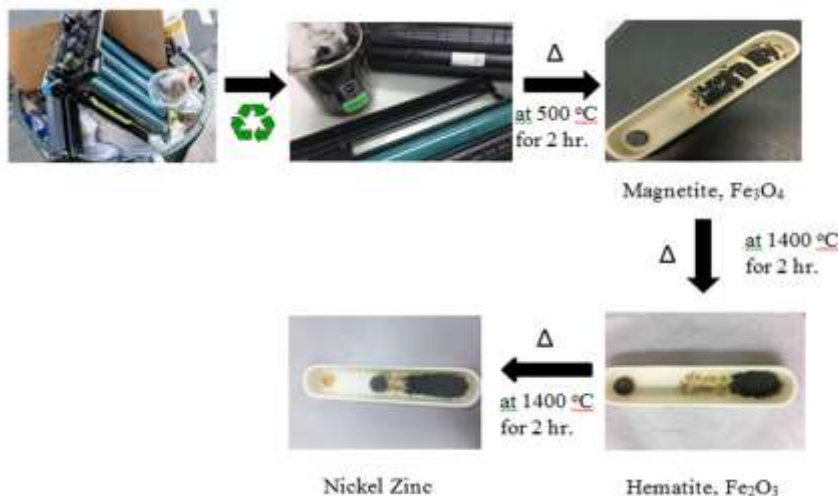


- 1) The residual toner powder contains about 8% for an end-of-life toner for each toner cartridge.
- 2) The synthesizing of magnetite iron oxide can be extracted by using magnetic separation and reduction technique .
- 3) The extraction is done via simple and low-cost alternative.

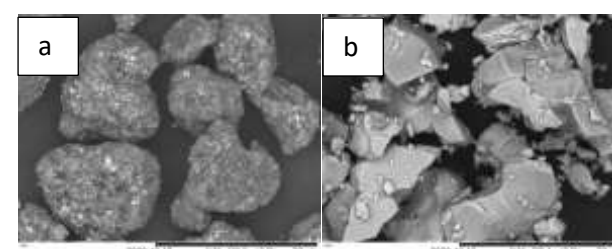
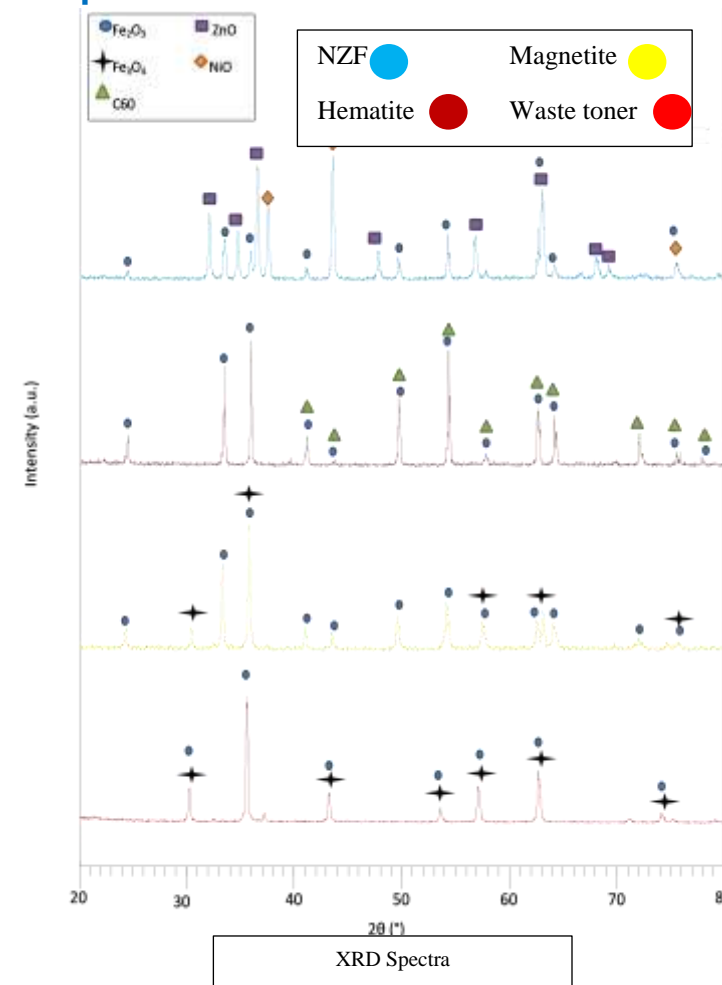
## Objective

- To recover magnetite ( $Fe_2O_3$ ) by magnetic separation technique and convert into  $Fe_2O_3$  using reduction technique.
- To synthesize Nickel Zinc Ferrite (NZF) using extracted iron oxide from waste toner powder.
- To study the structural, microstructural and magnetic properties of Nickel Zinc Ferrite (NZF) prepared using extracted  $Fe_2O_3$  as main component.

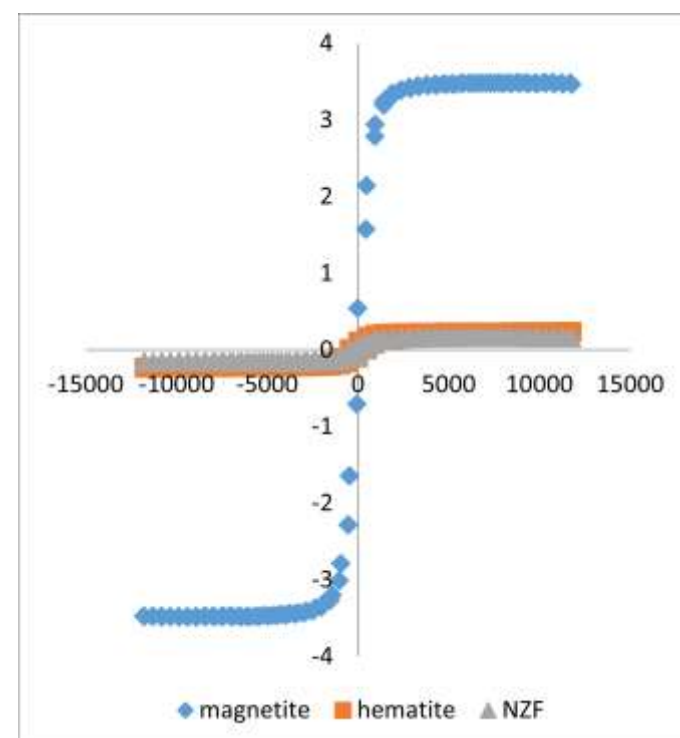
## State of the Art/ Methods



## Graphical Results

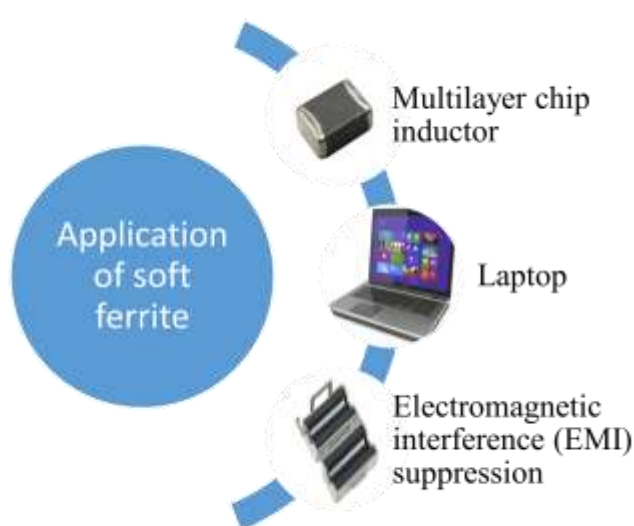


SEM image of a) waste toner and b)  $Fe_2O_3$  at magnification of 3000x.



## Environmental Impact

- Valuable metals from waste toner were recovered.
- The number of discarded toner cartridge can be reduced.
- Reduce leaching of toxic chemicals from toner powder into landfill.



## Conclusion

- Based on XRD analysis, the major composition in waste toner was iron oxide ( $Fe_2O_3$ ).
- The addition of PET to magnetite powder acts as a reducing agent for reduction process from magnetite ( $Fe_3O_4$ ) to hematite ( $Fe_2O_3$ ).
- As for saturation magnetization,  $Fe_3O_4$  sample had the highest value with 3.4878 emu/g compared to  $Fe_2O_3$  sample with 0.23313 emu/g while for NZF was 0.16075 emu/g.
- The area for all samples have smaller coercive forces which mean that they have smaller hysteresis loss, hence the samples were easily magnetized and demagnetized.
- As for squareness ratio, the NZF sample had larger value with 0.45722 compared to  $Fe_2O_3$  and  $Fe_3O_4$  with 0.43661 and 0.14325 respectively.

## Acknowledgment

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## Status of Innovation

- TRL Level 1
- Status of Finished Product: Proof of concept
- Functionality of Product: Replacement of hematite ( $Fe_2O_3$ ) used in ferrites