

## Effect of variation sintering temperature on magnetic permeability and grain sizes of Y<sub>3</sub>Fe<sub>5</sub>O<sub>12</sub> via mechanical alloying technique

### ABSTRACT

This work will focus on the preparation of yttrium iron garnet (Y<sub>3</sub>Fe<sub>5</sub>O<sub>12</sub>, YIG) via mechanical alloying technique derived by steel waste product. The Fe<sub>2</sub>O<sub>3</sub> powder derived from the steel waste purified by using magnetic and non-magnetic particles (MNM) and Curie temperature separation (CTS) technique. The purified powder was then oxidized in air at 500 °C for 9 hours in air. The Fe<sub>2</sub>O<sub>3</sub> was mixed with Y<sub>2</sub>O<sub>3</sub> using high energy ball milling for 9 hours. The mixed powder obtained was pressed and sintered at different temperatures 500/600/700/800/900/1000/1100 °C. X-ray diffraction (XRD) shows the YIG is completely formed at 1100 °C. The field emission scanning electron microscopy (FESEM) images show that the grain size increases as the sintering temperatures increase. The frequency dependence of the complex permeability,  $\mu'$  and magnetic loss,  $\mu''$  in the frequency range 10 MHz to 1 GHz were measured in this study. The results showed that the highest  $\mu'$  is 5.890 obtained from 1100 °C.

**Keyword:** Porous cavity; Wavy wall; Thermal dispersion; Nanofluid; Numerical results

