INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student	:	R. VIGNESH BABU
Roll Number	:	136103035
Programme of Study	:	Ph.D.

Thesis Title: Studies on the influence of processing techniques and their parameters on the characteristics of Cu/CNT composites having different CNT size and its concentration for steel industries

Name of Thesis Supervisor(s)	:	Prof. S. KANAGARAJ
Thesis Submitted to the Department/ Center	:	MECHANICAL ENGINEERING
Date of completion of Thesis Viva-Voce Exam	:	23/07/2019
Key words for description of Thesis Work	:	Copper/Carbon nanotube composites, heat transfer applications

SHORT ABSTRACT

In current era, there is a high demand for energy efficient materials and processes in order to reduce their impact in our environment, natural resources and carbon foot print. Due to stringent requirements, steel industries are looking for improving the efficiency of a plant using different approaches including energy efficient-thermal management systems and materials e. g. staves in a blast furnace and heat transfer tubes in heat exchangers. The main objective of the present work is to develop Cu/CNT composite materials and characterize them in order to explore the same for potential industrial applications in general and steel industries in particular. In this work, the molecular level mixing (MLM) technique is followed to synthesize the Cu/CNT composite powder. The Cu/CNT composite powder is compacted using uniaxial compaction (UA) at 800 MPa followed by either conventional (CS) or microwave sintering (MW) technique to obtain the final sintered test samples. In addition, the Cu/CNT composite powder is also consolidated through cold isostatic press (CIP) at 300 MPa followed by microwave sintering. The sintering duration of composites is greatly reduced by the synergic effect of CNT and temperature. The grain size of the composites is increased with CNT size, its concentration and sintering duration. The hardness of the composites is observed to be 88.8 ± 2.5 VHN at 0.25wt.% of 40-60 nm diameter CNT composites sintered at 600 °C for 75 min. irrespective of processing technique. The maximum electrical and thermal conductivity of CIP-MW processed composites are observed to be 50.4 ± 0.2 MS/m and 372.8 W/mK at 93.8% relative density (RD) for the 0.25wt.% of 20-40 nm diameter CNT composites sintered at 600 °C for 75 min., which is about 20% higher than that of pure Cu obtained by the same technique. The thermal conductivity of the composites obtained by the CIP-MW processing technique is found to be superior in comparison that of other techniques and the results are found to be at par with that of the results obtained from the spark plasma sintering technique.