

A  
**Dissertation Report**  
ON  
**Fabrication of Thermoelectric Material- Manganese Silicides ( $\text{MnSi}_{1.73}$ )  
through Powder Metallurgical route and analysing its Thermoelectric  
Properties**

Submitted in partial fulfilment of the requirements of the degree of  
**Master of Technology**

In  
**Process Metallurgy**

Submitted By

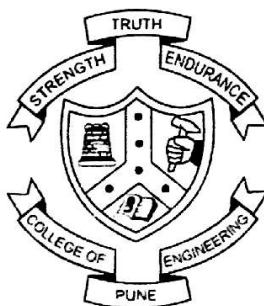
**SHANKAR PRAKASH NAGANOOR**

**(MIS No.: 121527013)**

Under the Guidance of

**Prof. VAISHALI PODDAR**

**Department of Metallurgy and Materials Science**



**DEPARTMENT OF METALLURGY AND MATERIALS SCIENCE**  
**COLLEGE OF ENGINEERING PUNE**  
**(An Autonomous Institute of Govt. of Maharashtra)**

## Abstract

Owing to the increased demand for energy and the negative environmental consequence of energy generation from fossil fuels, thermoelectric materials can be used to convert waste heat into electricity, have received renewed attention in the past decades. Thermal management and energy crisis have been two major problems in this 21st century. Amongst the thermoelectric materials, Manganese-Silicide (MnSi) is emerging as an alternative promising high temperature semiconductor useful for temperature from 600-900°C.

Mechanical Alloying process has been used to produce Manganese-Silicides (MnSi). The powders of Manganese (99.6%, less than 10 $\mu$ ) and Silicon (98.5%, 200 mesh) were blended in an attritor mill (AM) for 6-10h. Then the milled powders were hot compacted by using Hot Press Sintering (HPS) with the permutations of temperature (900-1000°C), pressure (35-45MPa) and holding period (4-8min). The compacted samples were annealed in vacuum furnace at 900°C for 12h holding period. Phase transition during the process was investigated using DTA, XRD, SEM and EDS. Thermoelectric properties were determined by using in-house developed Seebeck set-up. The Seebeck coefficient was found to increase with increase in temperature with the maximum of around 67.5 $\mu$ V/K at 978K and the ZT value was estimated to be around 0.85 at the same temperature.

**Keywords:** Manganese-Silicides, Annealing, Thermoelectric, Mechanical alloying.