CHAPTER 1

INTRODUCTION AND OBJECTIVES

1.1 Introduction

In the recent years, Composite materials have gained popularity in high-performance products that need to be lightweight, yet strong enough to take harsh loading conditions such as aerospace components, boat and scull hulls, packaging, coating, sport, bicycle frames, and racing car bodies [1, 2]. Especially, the polymer-based composites reinforced with a small percentage of strong fillers can significantly improve the mechanical, thermal and barrier properties of the pure polymer. Moreover, these improvements are achieved through conventional processing techniques without any detrimental effects on process ability, appearance, density and aging performance of the matrix [3]. The realization of their unique properties, it has been considering for a wide range of applications including packaging, coating, sport, electronics, aerospace industries, aircraft and military, automotive, and marine engineering [4–6].

For the polymer matrix, epoxy resin is one of popular materials which has widely been used as structural adhesives because of its excellent bonding, thermal and mechanical characteristics [7]. The conventional fibers, for examples, grass – fiber, carbon – fiber and aramid – fiber are widely used in nowadays. However, these materials are still limited in some applications, especially; the aircraft engine and aerospace industries need high temperature materials, high mechanical properties that are lightweight [8]. Therefore, there are many works focus on the reinforcing polymer-based materials. These materials have incorporated various particle/whisker-

type fillers especially, the fillers in nanoscale has had great attention for example, adding carbon nanotubes (CNTs) improve the electricity, mechanical properties. In recent years, CNTs have been utilized as fillers in polymer matrix composites [9-11] because of their unique structure and extraordinary mechanical, thermal, and electrical properties [12-16].

Moreover, the new type filler, silicon carbide nanowires (SiCNWs) have been attracting considerable attention due to their excellent properties such as high thermal stability, high thermal conductivity, good mechanical properties, and chemical inertness [17, 18]. Besides, it has been suggested as good reinforcement materials and suitable to be used as the reinforcing material for composites due to their much larger strength over their bulk counterparts and strong interfacial bonding [19]. Therefore, they can be used in nanoelectronics, field emission device, biomedical engineering, nanocomposites and applications in high temperature nanoscale devices [17, 20, 21]. In this present study, to investigate the nanocomposites of CNTs, SiCNWs and epoxy resin materials. CNTs and SiCNWs were synthesized by the chemical vapor deposition (CVD) method [6, 9-13, 22, 24] and use for improvement properties of polymer by adding CNTs and SiCNWs into epoxy resin. Physical and mechanical properties were investigated and microstructure of samples was determined by Scanning Electron Microscopy (SEM) technique.

1.2. Objectives

The objective of this research can be divided into 2 parts. Part I, is the synthesis of silicon carbide nanowires (SiCNWs) by CVD method, in part of synthesis of carbon nanotubes was followed the synthesis process of CNTs was reported by Singjai et.al

[24] and characterized by XRD, SEM, TEM and EDX. Part II, is the fabrication of CNTs/SiCNWs/epoxy resin nanocomposites. The matrix that used in composites samples is epoxy resin. The dispersed phases are CNTs, SiCNWs. The physical and mechanical properties, such as density, tensile strength, compressive strength, impact strength, wear resistance nanocomposites materials are investigated. Furthermore, the microstructure of the sample is also determined using SEM technique.