STUDY OF THE MANUFACTURING PARAMETERS AFFECT THE FABRICATION OF NANO AND MICRO COMPOSITES

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Abstracts: In this research the fabrication quality parameters of micro and nano composites will be mentioned. The manufacturing parameter such as temperature, pressure, and cooling rate were studied. Poly methyl metha acrylate reinforced by fiber glass was considered as case study in the current work. The effect of fiber size (length to diameter ratio) and fiber volume fraction were evaluated. The fabrication temperature of the composite was evaluated. The factors affecting the heating rate such as power, volt and furnace efficiency were studied. At the end of research, the results and discussions explain the main parameters affecting fabrication of nano and micro composites.
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Introduction

Polymer nanocomposite have attracted great attention due to the unique properties introduced by nanofillers, which typically refer to carbon blacks, silicas, clays or carbon nanotubes (CNT). The polymer matrix acts as a supporting medium and the improvement in the properties of nanocomposites generally originates from the nature of these nanofillers[1],[2]. The term reinforcement is normally used to denote the increase in rigidity and strength achieved by dispersing inorganic fibers or particulates fillers in the polymer matrix [3]: [7].

Effectiveness of fiber in the composite

The effectiveness of fibers or reinforcements in the composite depends mainly on three factors [8], [9]. **First**, it must have good bond strength between the polymer matrix and the fibers, this is usually achieved by coating the fiber with a material which bonds well to both fiber and polymers [10] **Second,** the effect of fiber concentration on the properties of the composites [11] :[16].**Third,** The effect of fiber size in the other words, the effect of length to diameter ratio [17]: [20].

In general, the fibers are assumed to be homogeneous, much stiffer than the polymer matrix, regular spaced, perfectly aligned or randomly distributed. The polymer matrix is assumed to be homogeneous and isotropic linear elastic [21], [22]. The interface between the fiber and the polymer matrix is an anisotropic transition region which must provide a stable bond between them [23], [24].

Solvent casting, melt mixing and coagulation methods are the common fabrication methods for nano-composites, some researches use combined methods, such as solvent casting in conjunction with sonication followed by melt mixing [25],[26]. For example the combination of solvent casting and melt mixing for SWNT/PMMA composites with considerable improvement in nano-tube dispersion [27], [28]. PMMA was dissolved in organic solvent that was also used to disperse additives and after that it cast into a dish. In situ polymerization method has also been used to make nano-tube-based nano-composites starting with nano-tube and monomers [29], [30]. The most common in situ polymerization methods involve epoxy in which the resin (monomer) and hardeners are combined with additives or reinforcement prior to curing (polymerization) [31],[32]. Its resin can be cross-linked after mixing with hardener [33], [34].

The development of nanotechnology is closely related to the new economy and high technology products towards 21st century [35]. As a new material, the nano-particle has certainly caught the imaginations of researchers around the world. Although the production technologies of nano-particles have had significant progress in the past few years, the commercial applications

of nano-particles are often limited by the cost, handling, and safety issues [36], [37]. To address these application problems, a proprietary mechanic-chemical bonding technology has been developed to fabricate nano-composite powders. It can create nano-scale multifunctional composite materials contributing to the development of advanced materials and devices for rechargeable batteries, fuel cells, ceramics, metals, superconductors, cosmetics and pharmaceuticals. The technology is an enabling technique to broaden the applications of nano-particles. In these work, new method was developed, the nano materials can be bonded together using mechanical energy without any binders in a dry process [37].

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