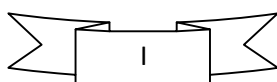


ISRAA FAISAL OHAZI. Modeling and Characterization of Polymer Composite Materials Reinforced with Particles. University of Technology. Materials Engineering Department. M.Sc. Supervisor Asst. Prof. Dr. Jawad K. Oleiwi, Asst. Prof. Dr. Farhad M. Othman. 2012. 92P

Abstract

This work focuses on the preparation of base polymer matrix composite materials by (Hand Lay-Up) method, and studying the effect of selected volume fractions (3, 6, 9, and 12) % of adding (SiO_2) ceramic particles in different particles size of (25 μm , 53 μm , 75 μm , 106 μm and 212 μm) to PMMA resin. Also many specific tests were performed on these composites. The effects of the variables (particle size and volume fraction) on the mechanical properties which include: ultimate tensile strength, elongation percentage at break, modulus of elasticity, bending modulus, flexural strength, max. shear stress, impact strength and fracture toughness and hardness were studied. The effect on the physical properties which include: water absorption and thermal conductivity was also studied. The results have revealed that the values of tensile modulus of elasticity, elongation at break, tensile strength, bending modulus, hardness and water absorption percentage will increase with the addition of reinforcing fillers, on the other hand, the values of fracture toughness and impact energy decrease with increase in fillers percentage. Silica fillers with small particles size increase these properties more than large particles size fillers.

Tensile test results show that tensile strength has increased with increasing volume fraction of (SiO_2) fillers particles and reached their maximum value at (12 % vol). The largest values of ultimate tensile strength, modulus of elasticity and percentage of elongation at break are



(36 MPa, 1.177 GPa and 3.34 %) respectively for the composite reinforced by (12% vol) with silica fillers in (25 μm). Also results show that fracture toughness and impact strength decrease with increase in volume fraction of the prepared system.

Flexural strength, bending modulus and max. shear stress of the prepared composite materials increase with increasing volume fraction and decreasing particles size of filler particles, reaching a maximum value of (355.19 MPa, 5120 MPa, 10.06 MPa) at (12% vol) and (25 μm) respectively. Hardness test results show that hardness increases with increasing volume fraction of filler particles and reaches maximum value of (86) at (12 % vol) addition and particle size was (25 μm).

The water absorption percentage as a physical property for the prepared composite material has shown an increase with increasing volume fraction of filler particles. The thermal conductivity also increases with the increase in the volume fraction of reinforcing fillers.

Statistical and mathematical analyses are used to process the experimental data. A mathematical model is done which shows the mechanical and physical properties of composite materials as a function of particles size and volume fraction.

Keyword : SiO_2 , PMMA, mechanical and physical properties ,mathematical model

