World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:17, No:04, 2023

Investigation of Mechanical Properties and Positron Annihilation Lifetime Spectroscopy of Acrylonitrile Butadiene Styrene/Polycarbonate Blends

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Abstract : The main objective of this research is to study the effect of adding polycarbonate (PC) to pure Acrylonitrile Butadiene Styrene (ABS) using the injection moulding process. The PC was mixed mechanically with ABS in 10%, 20%, 30%, 40%, and 50% by weight. The mechanical properties of pure ABS reinforced with PC were investigated using tensile, impact, hardness, and wear tests. The results showed that, by adding 10%, 20%, 30%, 40%, and 50% wt. of PC to the pure ABS, the ultimate tensile strength increased from 55 N/mm2 for neat ABS to 57 N/mm2 (i.e. 3.63%), 60 N/mm2 (i.e. 9.09%), 63 N/mm2 (i.e. 14.54%), 66 N/mm2 (i.e. 20%), 69 N/mm2 (i.e. 25.45%) respectively. Test results also revealed nearly 5.72% improvement in young's modulus by adding 10% of PC to ABS, 16.74% improvement by adding 20%, 23.34% improvement by adding 30%, 27.75% improvement by adding 40%, and no other increase in case of 50%. The impact test results showed that with the increase of the PC content, first, the impact strength decreased and then increased gradually. The impact strength decreased rapidly when the content of PC was 0% to 10% range. As well as, in the case of 20%, 30%, 40%, and 50% PC, the impact strength is increased. The hardness test results, using the Shore D tester, showed that, as the PC particles contents increased, the hardness increased from 76 for the ABS to 80 for 10% PC, and decreased to 79 for 20% PC, and then increased to 80 in case of 30%, 40%, and 50% PC. Wear test results showed that PC improves the wear resistance of ABS/PC blends. Positron annihilation lifetime spectroscopy showed that with an increase of PC in ABS/PC blends, a slight decrease in free volume size and an increase in the tensile strength due to good adhesion between PC and ABS matrix, which acted as an advantage in the polymer matrix.

Keywords : ABS, PC, injection molding process, mechanical properties, lifetime spectroscopy
Conference Title : ICAMDME 2023 : International Conference on Applied Mechanics and Design in Mechanical Engineering
Conference Location : Beijing, China
Conference Dates : April 03-04, 2023