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Effect of cryogenic treatment on adhesion phenomenon at interface in wollastonite reinforced PBT composites

K. N. Pande, D.R.Peshwe and Anupama Kumar
Visvesvaraya National Institute of Technology (VNIT), India

In this paper investigations on the influence of cryogenic treatment especially on extent of adhesion between of filler and matrix interface of PBT/wollastonite an engineering composite, with varied content of filler loadings 0(W0),5(W1),10(W2), 20(W3) & 30(W4) % by weight. The selected material is treated at different temperatures (-80°C,-140°C &-185 °C) for stipulated time period (4, 8, 12,16,20,24 hrs) in the cryostat and then tested at ambient temperature. The properties of 'un-treated' and 'cryo-treated' materials are evaluated in a comparative manner for their mechanical, structural, and thermal properties. Tensile strength exhibited a marginal increase on cryo-treatment whereas a dramatic increase was observed in modulus with an increase in filler loading. The experimental results for the moduli were also compared with theoretical predictions which revealed good level of interfacial interaction in the cryo-treated composites. It was indeed observed that lower loadings of fillers were effective in significantly decreasing friction coefficient and wear loss as compared to virgin PBT, but higher wt. % deteriorated the wear performance in case of untreated sample. Whereas for all studied composites the relative improvement in wear performance on cryo-treatment is observed irrespective of wt. % loading as compared to untreated samples. SEM images of composite authenticate the weak and good adhesion for untreated and cryo-treated samples respectively. This change in morphology is co-related with covalent bond formation as evaluated through FTIR study. Increase in melting temperature (T_m) confirms the material is becoming thermodynamically more stable after cryo-treatment. The optimization of the cryo-treatment parameters was done from the data through characterization. Thus 8 hrs and -185° C can be considered as optimized condition for cryo-treatment of the studied composites.

kavita_pande1@rediffmail.com