Thermal expansion of nanocomposite Al + 0.25% NTCM

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The objective of this note is the dilatometric study of nanocomposite Al + 0.25% NTCM.

The demand for materials containing nanometric additions is steadily increasing in the different strategic areas. . Their use in areas ranging from space to medicine has made considerable progress.

The dilatometric measurements reveal the presence of an accentuated anisotropy. The relative variations of the elongation L / L in the X and Z directions are clearly distinct. L / L (Z) is significantly less than L / L (X) throughout the temperature range. At high temperature 600 ° C, the ratio between the two ratios exceeds 300% and the two representative curves change uniformly. As for the variations of the coefficients of thermal expansion as a function of the temperature, they are different. From 150 ° C the behavior of  along the Z direction is a straight line. At 600 ° C, the value of  does not exceed 6 10-6C-1. It is of the same order of magnitude as the coefficient of thermal expansion of multiwall carbon nanotubes determined experimentally or calculated theoretically. This allows us to say that the NTCMs govern the dilation. On the other hand in the direction X, the variation of  is also monotonous, but the order of magnitude is of 400% on practically all the temperature range studied. This decrease of  in the direction Z can have several reasons. . The formation of the oxide layer Al2O3, Al4C3 aluminum carbide and densification of the nanocomposite can cause the drastic reduction of the expansion. This state is responsible for improving the dilatometric behavior of Al + 0.25% NTCM. The use of other techniques such as DSC, X-ray, infrared and Raman confirmed the improvement of the characteristics of the nanocomposite studied.