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Dependence of Coefficient of Volumetric Thermal Expansion (CVTE) of Glass Fiber Reinforced (GFR) Polymers on the Glass Fiber Content

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In a Glass Fiber Reinforced (GFR) polymer, the coefficient of volumetric thermal expansion CVTE (determined as a sum of the coefficients of linear thermal expansion CLTE's for the three principal directions) is sometimes much smaller than the value predictable on the basis of well acquainted models, such as Chow model, taking into account fibers anisotropy and aspect ratio.

A detailed investigation of the CVTE of unfilled and GFR thermoplastics (polyethyleneterephthalate PET, polybuthyleneterephthalate PBT, polyamide 6 PA6, polyamide 4,6 PA46, polycarbonate PC) was performed through Pressure-Volume Temperature (PVT) measurements. In particular, it was found that CVTE is always much lower than the zeroth order "expected value", defined according to the "rule of mixture". The aspect ratio plays a major role, since in the case of polymers filled with glass spheres the rules of mixtures applies for the resulting CVTE. Finally, the nature of the matrix is of paramount importance: a GFR polymer with an amorphous matrix (PC) strictly follows the rule of mixture for CLVE even for highly anisotropic fillers exhibiting large aspect ratios (20 to 30).