

Investigation of Thermal Behavior of Cyanoacrylate in the Presence of Nano-sized SiO₂

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Nowadays, solvent-free, one-part cyanoacrylate adhesive widely used in a range of industries including the automotive, beauty aid, electrical, electronic, machinery, medical, and plumbing [1-3]. According to literature survey done by the authors, there are a few papers concentrated on role of nano-sized particles on thermal behavior of cyanoacrylate glue. Thus the main goal of current research has been focused on clarifying the role of nano-sized SiO₂ on thermal behavior of cyanoacrylate. For this purpose, 1 Vol% of para-toluene sulfonic acid was dissolved in cyanoacrylate as polymerization inhibitor [2] and various amounts of nano-sized SiO₂ powders were added to the cyanoacrylate base composite. Moreover, caffeine was used as a polymerization initiator to cure cyanoacrylate in an appropriate time [3]. It is worth noting that without such initiator, polymerization will be postponed for several days.

Transmission electron microscopy (TEM) was used to observe the dispersion of nano-sized SiO₂ inside the matrix (i.e. cyanoacrylate). Thermal behavior of all materials including cyanoacrylate and its nanocomposites was studied using DSC and TGA methods.

TEM micrographs prove that nano-sized SiO₂ disperse in cyanoacrylate adequately. The results of DSC show that increase in amount of nano-sized SiO₂, results in decrease in duration of cyanoacrylate curing, energy release during polymerization and starting time of polymerization. Furthermore, the results of TGA test illustrate that the weight loss of cyanoacrylate strongly depends on both caffeine and SiO₂ content. In fact, an increase in nano-sized SiO₂ content promotes degradation temperature of cyanoacrylate.

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