

Summary

The relation between the structure and the properties of polymer nanocomposite materials with matrixes on the basis of cyanic esters and inclusion organophilic montmorillonite (MMT) is investigated in the subject thesis. The objective of the research was the development of innovative thermosets with competitive properties, against the commercial corresponding ones which are used in plane repairs (composite batch repair). Although polycyanurate networks (PCN) present excellent properties they are characterized by high brittleness at room temperature conditions. This problem can be solved by adding flexible polymeric components, which, on the other hand, degrade the mechanic resistance of the material. In pure PCNs, PCNs with polytetramethylene glycol (PTMG) or polysulfone (PSF) and poly(oligo urethane)methacrylate (PUMA) small concentrations of organophilic MMT (Cloisite, Nanomer) are added in order to strengthen them mechanically.

The molecular mobility of materials as well as their glass transition were studied by the techniques of dielectric spectroscopy. The progress of curing was studied by dielectric measurements taken in-situ upon polymerization of samples. Regarding the distribution of nanoparticles, glass transition, thermal stability, degree of curing, as well as percentage of saturated water, we received information by techniques of X-ray scattering, TEM microscopy, DSC, TGA, IR spectroscopy and water uptake.

Morphological characterization experiments resulted in a dissemination of MMT of 60% intercalated/exfoliated in the PCN. This percentage is affected nor by the method of mixture neither by the type of MMT. In modified PCNs networks the interlayer distance of the inserted MMT was found longer than that in pure PCNs.

The study of the progress of polymerization has led us to the conclusion that the MMT is acting catalytically by decreasing the polymerization's induction time and, at the same time, by increasing the rate reaction. The time of gel formation and vitrification was found to be decreasing in presence of MMT. Finally it was observed that the catalytic action of MMT varies depending on the type of his modifier.

We studied the dielectric function of nanocomposites systems through dielectric spectroscopy. The real part of dielectric function was found to be higher than the corresponding pure matrix either when the matrix is pure PCN or when it is modified as described above. The study of dielectric relaxations showed that α -relaxation of PCN network which related to the glass transition plasticizes in presence of MMT and this plasticization depends on the percentage of inclusion. Experiments DSC verify the above. The position of β -PCN relaxation depends on the percentage of polymerization and the relaxation plasticizes when the polymerization is promoted. Also we observed that the particular mechanism which was characterized in the past as semi-cooperative is a complex mechanism and it can be analyzed in two relaxations. More rapid mechanisms as mechanisms γ are not influenced by the presence of MMT in the polymer matrix. The presence of water and flexible modifiers of PCN affect the position and the intensity. In hybrid nanocomposite materials the dielectric relaxations of flexible components anti-plasticize in presence of PCN network but do not present any significant modification in presence of MMT.

Water absorption experiments in all nanocomposite systems showed that presence of MMT results in increase of the percentage of absorbed water, probably because of the increase of network imperfections. Thermogravimetric analysis which took place for most from the materials showed that the MMT is unable to make a significant modification in the thermal stability of the hybrid and non-hybrid materials.