

## Preparation and properties of nanocomposites based on Nitrile rubber and Acrylic rubber (NBR/ACM) blends

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**Abstract** – Blends of nitrile rubber/acrylic rubber (NBR/ACM) and montmorillonite (MMT-20A) were prepared by two methods, melt and solution intercalation. The blends prepared by melt intercalation the clay was incorporate in an open two roll-mill with rubber blends. The other method was incorporated into the clay rubber in solution. The amount of MMT-20A was varied from 0 to 5phr. The X-ray diffraction (XRD) studies showed the disappearance of the XRD peak in all samples of NBR / ACM. The mechanical and physical properties of nanocomposites were improved with addition of MMT-20A which is proportional to clay concentration.

Recently, NBR/ACM blends have attracted significant attention due to their outstanding mechanical properties, solvent resistance and thermal stability [1]. However, these properties can improved by incorporation of the clay in blend [2].

Polymer-clay nanocomposites are a rapidly developing class of composites, wich is defined as a molecular composite of polymer and organophilic silicate layers of clay mineral. The dispersion of small amount of clay in the polymer matrix can impart radical improvement in mechanical properties, solvent resistance, ionic conductivity, flammability resistance, gas barrier properties, and biodegradability of polymers [2]. The polymer/clay nanocomposites can generally be prepared by common methods such as in situ polymerization, solution and melt mixing [3].

Acrylic rubber (ACM) (Hycryl ) was kindly supplied by Petroflex Ind. Com. S.A., Brazil. Nitrile rubber (NBR) (33 wt% acrylonitrile; Mooney viscosity (ML 1+4 at 100oC) = 50) was kindly supplied by Petroflex Ind. Com. S.A., Brazil. Montmorillonite modified (Southern Clay Products) with cationic exchange capacity (CEC) of 95 meq/100g was used in this work. In the first method, the blends with clay were prepared in an open two-roll laboratory mixing mill at room temperature. In the second method, the rubber was first dissolved in toluene. The MMT20A was dispersed in toluene for 24h. The required amount of the clay dispersion was poured into rubber solution and the mixture was agitated for 4 h. This solution was precipitate in methanol and dried in a vacuum for 3 days. Subsequently the compounding ingredients for vulcanization were mixed with this in an open two-roll mill at room temperature. All the blends were vulcanized up to the optimum curing time in a hydraulic press at 190°C and 15000 lb/in<sup>2</sup>. Tensile-strain experiments were performed by means of an Instron 5564 testing machine at room temperature with speed of 200 mm/min, following DIN procedure 53504. The samples were conditioned at 21°C and 53% of air humidity for 24 hours before the testing. The swelling measurements were utilized to determine the crosslinking density of the studies of NBR/ACM. The structure of the dispersed silicate layer in the composite was studied by XRD. The Figure 1 shows the diffraction peak of MMT-20A pure and the blends. The diffraction peak of MMT-pure in 2 theta = 3,5° (d001 = 25,24 Å). In the order hand, for all sample the former peak is quite totally absent and the latter is very poorly defined, evidencing the high proportion of exfoliated platelets or small clay aggregates constituted of a very small number of platelets. This trend indicates the efficiency of intercalation of blend. The Figures 2, 3 and 4 shows the tensile strength, elongation at break and crosslinking density. In all sample, the properties improved with the increase of the amount of clay in the mixture.

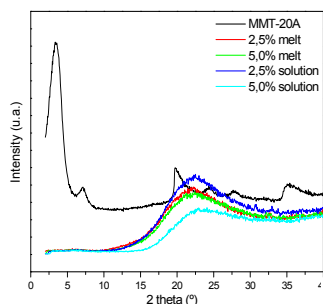


Figure 1: XRD partterns of NBR/ACM nanocomposites

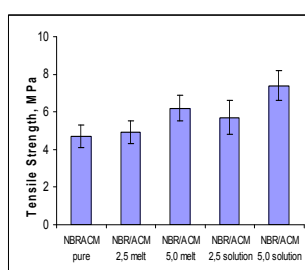


Figure 2: Tensile strength for NBR/ACM nanocomposites

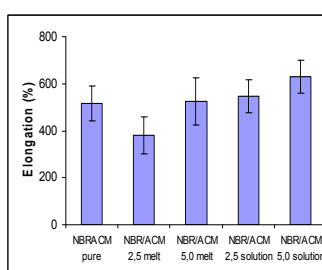


Figure 3: Elongation at break for NBR/ACM nanocomposites

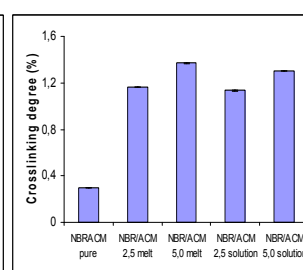


Figure 3: Crosslinking density for NBR/ACM nanocomposites

### References

- [1] M. L. Celestino, M. Oliveira, A.S. Sirqueira, B. G. Soares, J. Appl. Pol. Sc. (2009) 113: 721-729  
 [2] Y. Sun, Y. Luo, D. Jia, J. Appl. Pol. Sc. (2008) 107: 2786-2792  
 [2] M. Arroyo, M. A Lopez-Machado, J. L. Valentin, J. Carretero, Comp. Sc. And Techn. 67: 1330-1339.