Effects of nanoclay and nanocomposites on bitumen rheological properties

Main objective: Organoclay montmorillonite (OMMT) was prepared to be used as an additive for bitumen and for a polymer modified bitumen in order to analyze their mechanical and rheological properties. A nanoclay Cloisite 20 Å (CLO), was also investigated for comparison purposes. A bitumen was modified with 4% nanoclays (OMMT and CLO), with 4% SBS, and with 4% SBS/nanoclay.

Instrumentation: The X-ray diffractogram was obtained using a PAN analytical Xray diffractometer with geometry and mirror monochromator of cobalt radiation with a wavelength 1.78896 Å.

$$2d_{001} \sin\theta = n\gamma$$

Comparing the XRD pattern of CLO and OMMT, it is reasonable to assume that bitumen was more efficiently dispersed in the CLO interlayers than in the OMMT interlayers.

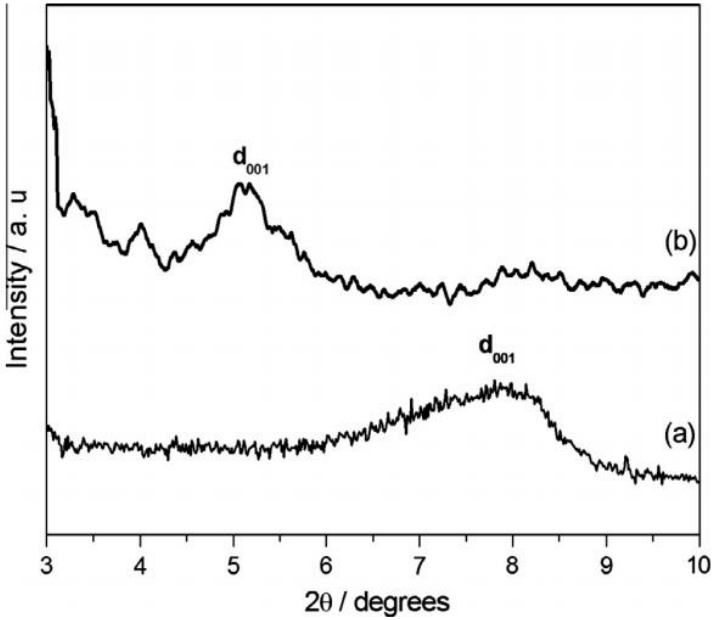

Fig. 3. X-ray diffractogram for (a) MMT and (b) OMMT.

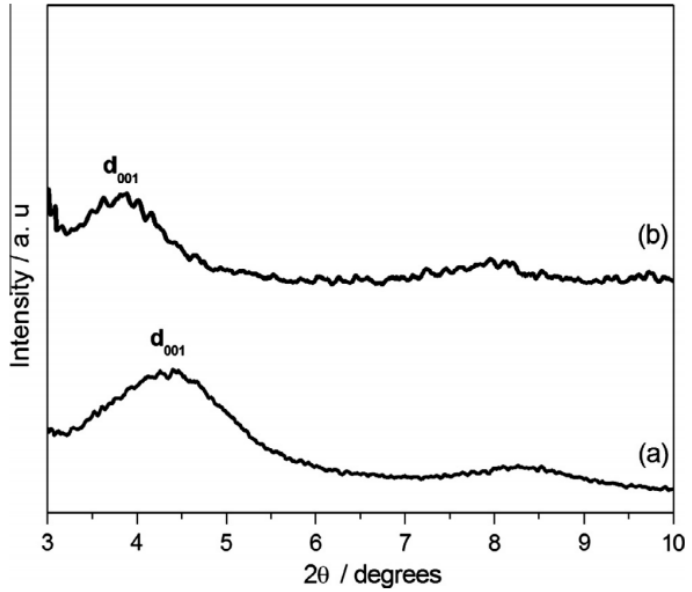

Fig. 4. X-ray diffractogram for (a) CLO and (b) SBSCLO nanocomposite.

The microstructures of polymer/layered silicate nanocomposites can usually be classified into three categories: intercalated, exfoliated and microcomposites, which can be characterized using the XRD technique relying on the position and the intensity of diffraction peaks in the XRD patterns

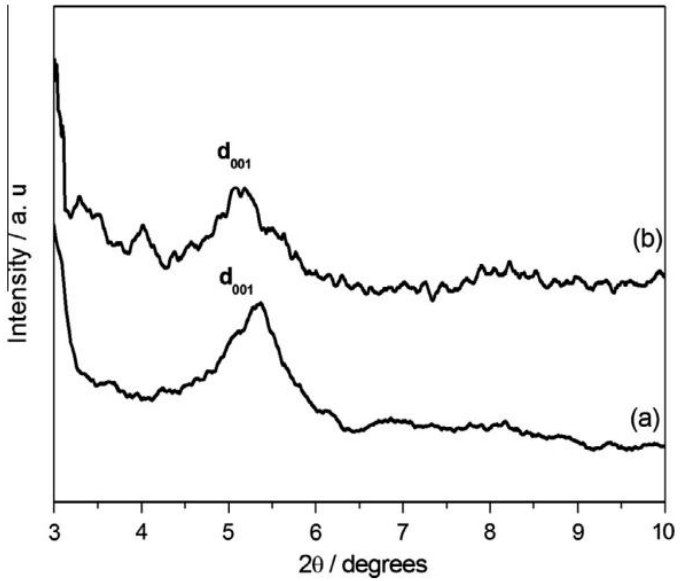

Fig. 5. X-ray diffractogram for (a) OMMT and (b) SBSOMMT nanocomposite.

Conclusion: The modified bitumens with SBS and SBS/nanoclays exhibited higher complex modulus (G*) and lower phase angle (d), which implies that these additives improved the resistance to rutting and elasticity of the bitumen.

Reference: Luísa Gardênia A.T. Farias, et.al., *Effects of nanoclay and nanocomposites on bitumen rheological properties*, Construction and building materials, 873-883, (2016).