## Open volumes structure and molecular transport in polymer and biopolymer nanocomposites

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We will discuss gas transport mechanisms in polymer nanocomposite in which fillers of different nature and concentration are added [1-5]. The kinetics of gas transport was studied by gas phase permeation techniques and free volumes were analyzed by positron annihilation lifetime techniques (PALS) with a fast-fast lifetime apparatus and with PLEPS beam at NEPOMUC facility. Gas barrier properties of two biopolymer nanocomposite films will be discussed in relation of their fractional free volume. The first biopolymer film is poly(3-hydroxybutyrate-co-3-hydroxyhexanoate) (PHBH) containing 0.25 wt. % of Graphene Oxide (GO) filler nanoparticles: PHBH is a biodegradable polymer that can be obtained either by microorganisms or chemical synthesis. The second biopolymer film is poly(lactic acid) (PLA) in which cellulose nano-fibrils have been dispersed with content ranging from 60 to 15 weight %. It will be shown that in both biopolymer films the filler addiction improves their gas barrier properties but with different mechanism. Introduction of GO in PHBH induces an increase of the gas impermeable PHBH crystalline fraction while introduction of cellulose nanofibrils in PLA modifies the structure of the PLA layers at the matrix-filler interface.

## References

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