colloids and interfaces

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Supplementary Materials

Rubber Surface Change and Static Charging under Periodic Stress

Leandra P. Santos [1], Yan A. S. Campo [2], Douglas S. da Silva [1], Thiago A. L. Burgo [2] and Fernando Galembeck [1,*]

[1] Institute of Chemistry, University of Campinas, Campinas SP, Brazil 13083-970
[2] Department of Physics and Department of Chemistry, Federal University of Santa Maria, Santa Maria RS, Brazil 97105-900

Sample characterization

ATR-IR spectra

ATR-IR spectra of the two samples used are in Figure 1, together with reference spectra from natural rubber, polybutene and polybutadiene taken from standard reference databases. There is a major difference between the two spectra that are the peaks marked with asterisks in b), that correspond to peaks in $CaCO_3$ spectra. Note that EDX data showed the presence of Ca, in discrete spots and also finely dispersed throughout the sample. Other spectral features verify the identity of the rubber according to the two suppliers.

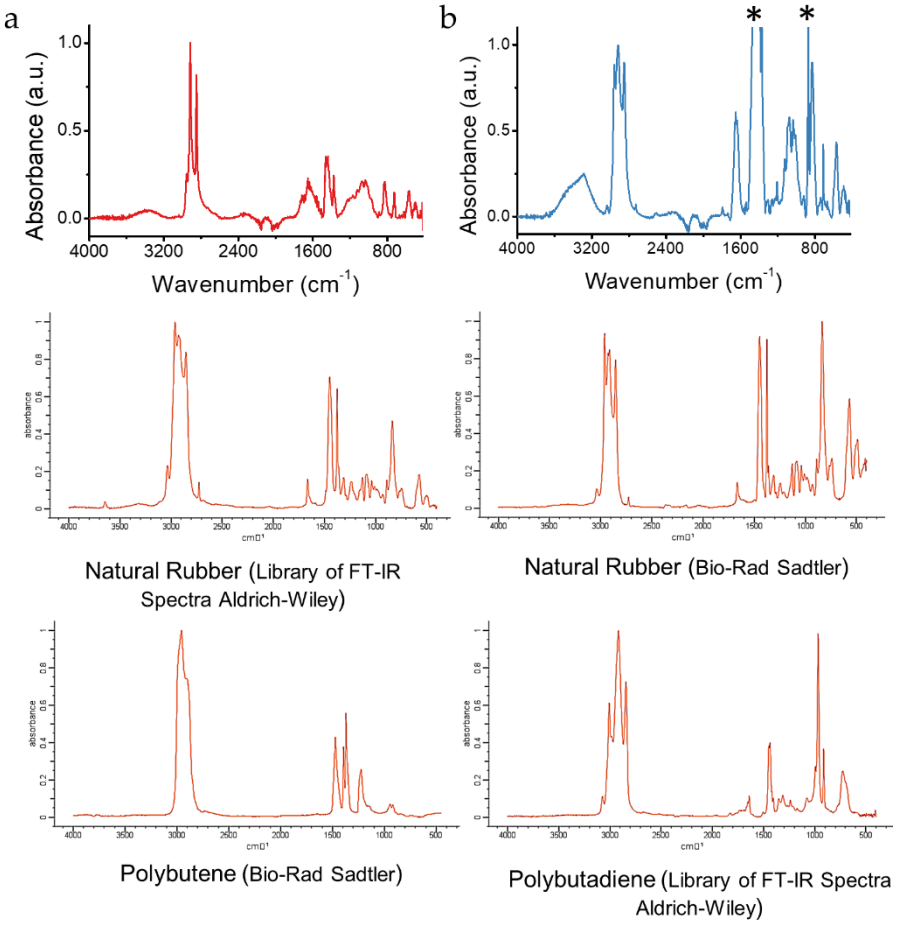

Figure 1. ATR-IR spectra from samples S (a) and L (b). The other spectra are for natural rubber and related rubbers, from standard reference sources.

Thermal analysis

Figure 2 shows DSC thermograms. There is good superposition of the curves obtained during successive scans (1st and 3rd), as expected for a stable rubber.

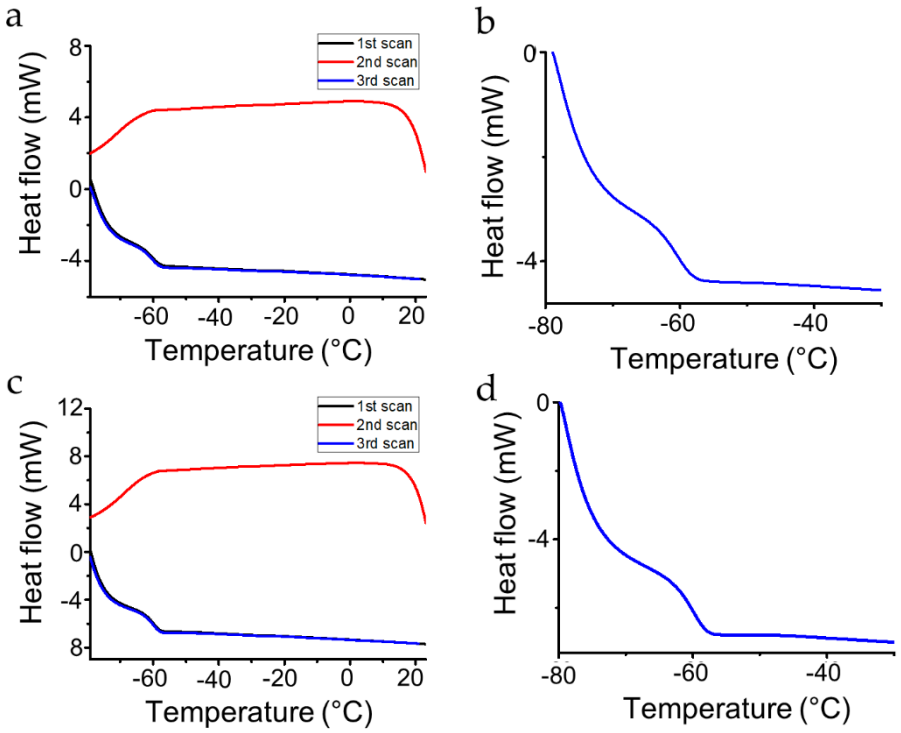

Figure 2. DSC plots from samples L (a,b) and S (c, d). b, d are amplified sections around T_g that was determined as -60.63 and 58,11.

Figure 3 shows curves obtained by thermogravimetric analysis. The curves obtained for both samples are identical except in one aspect: sample L shows much higher residual weight at 700 °C that is assigned to the calcium carbonate filler, in agreement with information from EDX and IR, for this rubber.

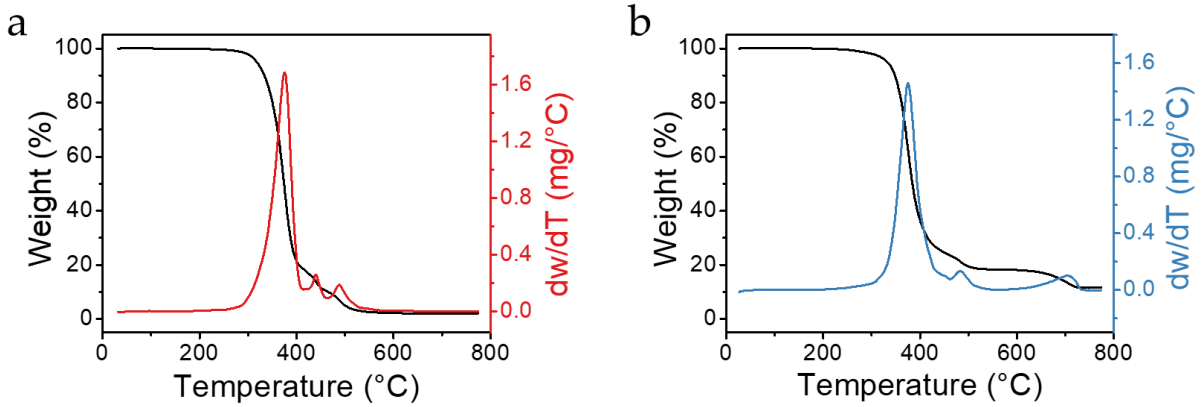

Figure 3. Thermogravimetry (absolute and differential) plots from samples S (a) and L (b).

Swelling

Xylene and water uptake by the two rubber samples was determined and the results are in Figure 4. Both rubbers absorb many times their weights of xylene but only a few percent weight water. Xylene absorption is consistent with an intermediate cross-linking degree, as expected for elastic rubber tubing and the lower absorption in L rubber is partly explained by the presence of calcium carbonate filler evidenced in EDX and ATR-IR results and verified in TGA. Lower absorption of water in S rubber is assigned to deproteinization and to the presence of finely dispersed Ca ions, evidenced in EDX data.

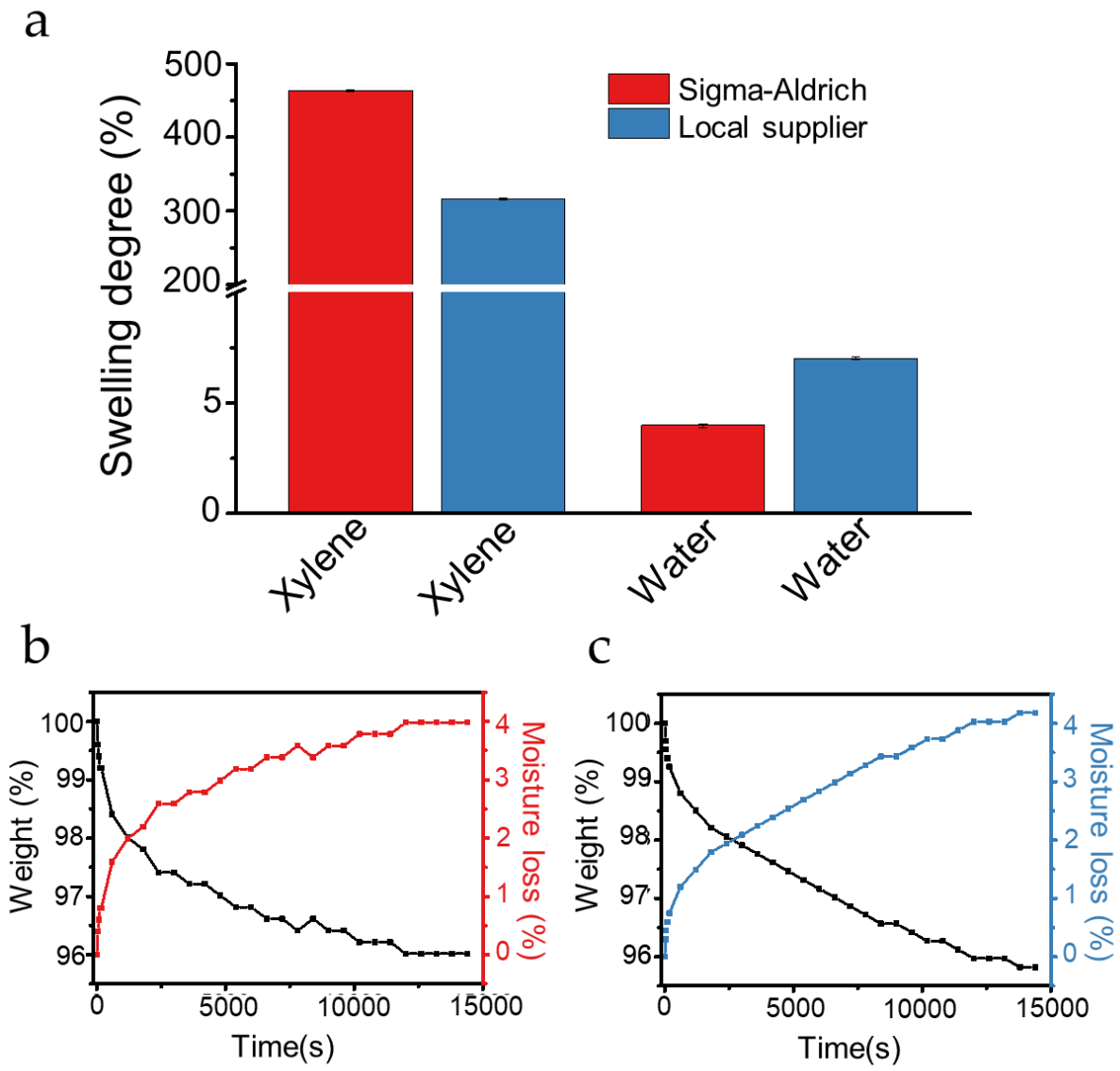

Figure 4. Swelling coefficients (a) for the two rubber samples, in xylene and water. Water uptake and desorption kinetics (50°C) of sample S (b) and L (c).