Supplementary material

S.1. Equations for models development

The strain invariants can be expressed in terms of the stretch ratios λ_1, λ_2, λ_3 (eq. 1, 2 and 3) [1]:

$$I_1 = \lambda_1^2 + \lambda_2^2 + \lambda_3^2 \tag{1}$$

$$I_2 = \lambda_1^2 \cdot \lambda_2^2 + \lambda_2^2 \cdot \lambda_3^2 + \lambda_3^2 \cdot \lambda_1^2 \tag{2}$$

$$I_3 = \lambda_1^2 \cdot \lambda_2^2 \cdot \lambda_3^2 \tag{3}$$

In our case, despite the fact that the CA/GO material is porous, as a first approximation, both polymeric mixtures were considered as incompressible; therefore, I_3 can be calculated as [1]:

$$I_3 = \lambda_1^2 \cdot \lambda_2^2 \cdot \lambda_3^2 = 1 \tag{4}$$

For uniaxial mechanical tests, it is possible to define the different stretch ratios (λ_1, λ_2, λ_3) in terms of the parallel stretch λ [1].

For a tensile test (eq. 5, 6 and 7) the main stretch is λ_1 (x axis):

$$\lambda_1 = \lambda \tag{5}$$

$$\lambda_2 = \lambda_3 \tag{6}$$

$$\lambda_2 = \lambda_3 = \lambda^{1/2} \tag{7}$$

Whereas, for a compression tests (eq. 8, 9 and 10) the main stretch is λ_2 (y axis):

$$\lambda_2 = \lambda \tag{8}$$

$$\lambda_1 = \lambda_3 \tag{9}$$

$$\lambda_1 = \lambda_3 = \lambda^{1/2} \tag{10}$$

S.2. Equation for determining the average absolute relative deviation

$$AARD\left(\%\right) = \frac{100}{n} \cdot \sum \frac{\sigma_E^{calculated} - \sigma_E^{\exp erimental}}{\sigma_E^{\exp erimental}} \tag{11}$$

1. Treloar, L.R.G. The elasticity and related properties of rubbers. *Rep. Prog. Phys.* **1973**, *36*, 755–826.