Introductory information:

Supplementary information for the publication: Influence of soapstone waste on the mechanical and rheological properties of HDPE

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ABSTRACT: Soapstone is an abundant mineral in Ouro Preto - Minas Gerais, Brazil and its main destination is in the production of craftsmanship. Rock recovery in those activities is low and the waste disposal is done with little control, which can be hazardous to the environment. This work proposes an alternative use of such potentially harmful waste as reinforcement in a novel polymer matrix composite, which can be particularly attractive to the automotive industry and of which very little information is available elsewhere in the literature. First, the characterization of the waste was performed. Particle size and shape parameters were determined by automated image analysis and the mineralogical composition was determined by X-ray diffraction, infrared and Raman spectroscopy. High-density polyethylene was used as matrix and the composites were made in three matrix/filler ratios: 90/10, 80/20 and 70/30 by weight. Tensile and rheological properties were measured in order to determine the influence of the particles on the polymer mechanical behavior and processing conditions. The materials showed a pseudoplastic behavior and the filler's influence was more pronounced in the 70/30 composites, which showed higher viscosities than the neat polymer. The addition of particles resulted in more brittle and rigid composites, with higher values of tensile strength.

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This dataset is composed of two Excel files: **Article_data_.xlsx**, **Mechanical_properties-composites.xlsx** that contain the data used in the publication: Influence of soapstone waste on the mechanical and rheological properties of HDPE – Journal of Applied Polymer Science (DOI: 10.1002/app.50966 – Under production).

Sharing and Access information:

Description of each file and the methodologies used in each data group:

FILE: **Article_data_.xlsx**: Excel file that contains all the data from each test performed within the scope of the paper.

EXCEL TABS:

- Particle analysis: size (CE diameter) and shape (Feret ratio and Circularity) data from the soapstone waste particles analysis. Statistics of the three parameters are also included in this tab. CE diameter stands for circle equivalent diameter, which is the diameter of a circle with the same area as the projected area of the particle image..
  - Method: The shape and size parameters of the soapstone particles were determined by automated image analysis with a Malvern Morphology 4, which has an integrated dry powder dispersion unit and can determine particle sizes in the range from 0.5 to 1300 µm.
- XRD: X-ray diffraction data from the soapstone waste analysis. This data was imported into the TOPAS software in which typical talc mineral reflections were identified. The diffraction angles, basal spacing and indices of the corresponding talc peaks are also listed in this excel tab.
  - Method: X-ray diffraction tests were performed with a D8 Discover diffractometer from Bruker, with copper radiation operating at 40 mA and 40 kV and with Lynxeye detector. The radial scan of intensity vs. diffraction angle (2θ) was recorded in the range 5°– 90° with a step of 0.02° and 1 second by step. The software TOPAS was used to obtain the crystalline structure and to determine the crystalline peaks and the respective diffraction angles.
- FTIR: Fourier Transform Infra-Red Spectroscopy (FTIR) data from the soapstone waste analysis.
  - Method: The infrared spectrum was obtained with a Perkin Elmer FT-IR Spectrometer (Spectrum Two Universal ATR), with range of 4000 - 400 cm^{-1}.
- Raman: Raman Spectroscopy data from the soapstone waste analysis.
  - Method: Raman spectrum in the range of 1200 - 50 cm^{-1} was obtained with a Horiba confocal Raman microscope (model Xplora), with 785 nm (green) Laser and 1200 gr mm^{-1} diffraction grating.

- Rheological behavior: Rheology test data and power law model calculations. The power law model was used to fit the shear stress data by the method of least squares.
  - Method: The rheology tests were made in a Discovery HR-3 rheometer from TA Instruments, with 40 mm parallel plate system operating with 5 cm gap at 180 °C and with shear rate ranging from 0 to 10 s^{-1}.
- Tensile testing – HDPE: tensile test data from eight high density polyethylene (HDPE) specimens. Each specimen is named CP01 to CP08 were CP stands for the Portuguese translation of specimen "*corpo de prova*".
- Tensile testing – 90/10: tensile test data from eight composites specimens with the following composition: 90 wt% HDPE and 10 wt% soapstone waste.

- Tensile testing – 80/20: tensile test data from eight composites specimens with the following composition: 80 wt% HDPE and 20 wt% soapstone waste.
- Tensile testing – 70/30: tensile test data from eight composites specimens with the following composition: 70 wt% HDPE and 30 wt% soapstone waste.
- Mechanical behavior: mean and standard deviation values from the mechanical properties of each material tested. The yield strength and relative elastic modulus data were fitted to some micromechanical models from the literature. These models are discussed in extension in the paper. The calculations performed by the method of the least squares are included in this excel tab.
    - Method: Mechanical properties were measured using a universal testing machine, Oswaldo Filizola ASME 2 kN. The tensile tests were performed at 50 mm/min and with initial distance between grips (L_0) of 25 mm. All tests were performed at room temperature (23 ± 2 °C). The test data were obtained by the Dynaview software and the properties were calculated using Excel. Stress-strain curves were obtained from each specimen test. The tenacity of the materials was calculated by measuring the area under the entire engineering stress-strain curve, while resilience was calculated by measuring the area under the engineering stress-strain curve up to the yielding point.

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FILE: **Mechanical_properties-composites.xlsx**: Contains One-way ANOVA analysis calculations, that were used to evaluate the significance of differences between the mean value of the mechanical properties (**Article_data_.xlsx / Mechanical behavior**) from each composition tested. Each tab in this Excel file contains the calculations from each property.
