

## Understanding the reinforcing behavior of expanded clay particles in natural rubber compounds

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### Supporting information:

**Table S1. Formulations of the NR compounds filled with different amount of EMT and OMT**

| Samples      | Gum | EMT | EMT | EMT | EMT | OMT |
|--------------|-----|-----|-----|-----|-----|-----|
|              |     | 2   | 4   | 6   | 10  | 10  |
| NR           | 100 | 100 | 100 | 100 | 100 | 100 |
| ZnO          | 3   | 3   | 3   | 3   | 3   | 3   |
| Stearic acid | 2   | -   | -   | -   | -   | 2   |
| EMT          | -   | 2   | 4   | 6   | 10  | -   |
| OMT          | -   | -   | -   | -   | -   | 10  |
| TBBS         | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| S            | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |

**Table S2. Parameter values of the Kraus model for E' for different NR-EMT nanocomposites**

| Sample | $\gamma_c$ | m    |
|--------|------------|------|
| EMT-4  | 3.27       | 0.35 |
| EMT-6  | 3.99       | 0.41 |
| EMT-10 | 3.18       | 0.60 |

**Table S3. Parameter values of the Maier-Göritz model for  $E'$  for different NR-EMT nanocomposites**

| Sample | $E'_{st}$ (MPa) | $E'_i$ (MPa) | c    |
|--------|-----------------|--------------|------|
| EMT-2  | 2.16            | 0.44         | 0.02 |
| EMT-4  | 2.70            | 1.00         | 0.06 |
| EMT-6  | 3.23            | 1.72         | 0.10 |
| EMT-10 | 3.75            | 3.32         | 0.14 |

**Table S4. Parameter values of the Maier-Göritz model for  $E''$  for different NR-EMT nanocomposites**

| Sample | $E''_{st}$ (MPa) | $E''_i$ (MPa) | c    |
|--------|------------------|---------------|------|
| EMT-6  | 0.209            | 0.165         | 0.11 |
| EMT-10 | 0.386            | 0.289         | 0.16 |

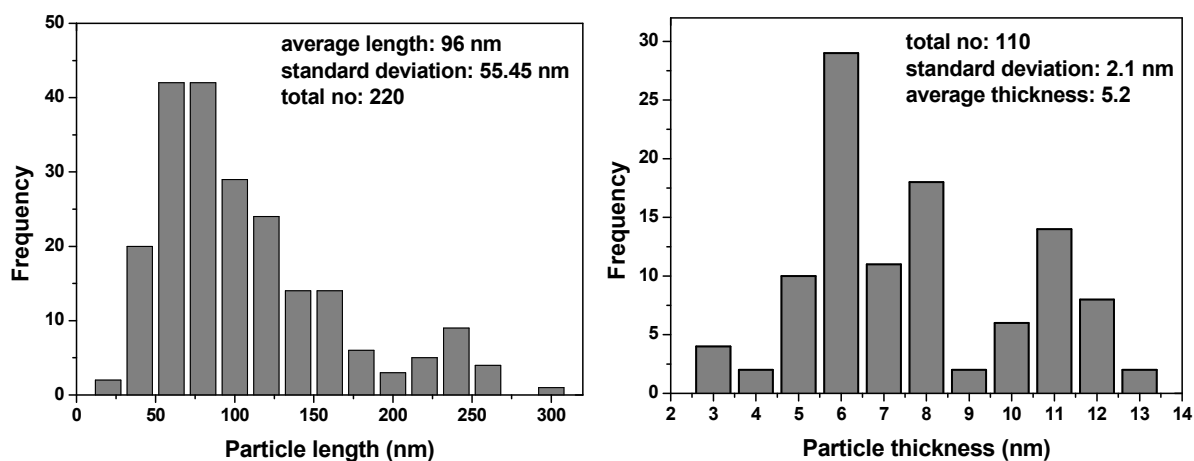
**Table S5. Parameter values of the modified Maier-Göritz model for  $E''$  for different NR-EMT nanocomposites**

| Sample | $E''_{st}$ (MPa) | $E''_i$ (MPa) | c    | a   |
|--------|------------------|---------------|------|-----|
| EMT-6  | 0.202            | 0.104         | 0.18 | 1.8 |
| EMT-10 | 0.353            | 0.241         | 0.22 | 1.9 |

**Fig. S1. TEM image analysis: Representative histogram**

To evaluate the effectiveness of the models, the predicted  $f$  was compared against the value determined from TEM analysis. These data were obtained by measuring numerous TEM photomicrographs of NR-EMT nanocomposites having different clay loading, i.e. 2-10 phr, due to the small variation of the aspect ratio with the filler concentration. We have used a software

namely as Scandium software. The observations were comprehended at high magnifications (more than 50K magnifications) in order to have a good overview of the organization of the clay tactoids at different scales. The TEM micrographs with an appropriate contrast were uploaded in the Scandium software. Scandium software was then utilized to measure manually the particle length ( $L$ ), thickness ( $t$ ). Histograms were finally calculated using origin software. This software allows particle size to be analyzed in a variety of ways allowing for the platelet dimensions and thus average aspect ratio to be determined. The average aspect ratio was finally estimated from the above histogram. The average value of aspect ratio was found to be 18. It should be noted that the average value of aspect ratio determined by TEM analysis can vary significantly depending on the measurements of platelet size used in the software and the person who measures. Normalized histogram is documented in Fig. S1.



**Fig. S1. Representative histogram of obtained from different micrographs**