Clay micromechanics: experimental challenges and perspectives

ABSTRACT

1. Introduction

models, inform “continuum”...
2. Clay Micromechanics

The forces existing between two surfaces are investigated using experimental techniques such as reversible (elastic) and non-reversible (plastic) behaviour. Theoretical models, such as the honeycomb, are used to understand particle interaction. The kink in a system is a measure of the evolution of the microstructure and interparticle interlayer forces. The limiting factor in the kinematics and interparticle interaction is the clay particle surface. The tetrahedral silica sheet and the octahedral alumina sheets bond together to form a unit layer. Depending on the nature of the interlayer and the water chemistry, the type of clay mineral is determined. Kaolinite is the most common clay mineral. Kaolinite is amphoteric and its charge is positive at low pHs, negative at high pHs, and constant at neutral pHs. The interlayer thickness of kaolinite is less than a micron and 10s Å. The basal spacing is a constant value for kaolinite. The apothem of a unit layer is less than a micron. The particle and clay particle surface are moving toward clay particles. Thanks to the increasing computational capability, numerical methods are being used to investigate particle interaction. The macroscopic scale of interest is to be carried out on a larger scale. The macroscopical soil particle analysis is to be carried out on a larger scale. The kinematic and interparticle forces are being investigated using experimental techniques such as Experimental Atomic Force Microscopy (AFM) and Reconstructing the forces existing between two surfaces. The experimental AFM investigations are corroborated or refined by investigations involving the microstructure of clays. The microstructure of clays has been lagging behind the macroscopic soil particle analysis. The microstructure of clays has been the lack of understanding and measuring clay interparticle forces. The difficulties in 1D/isotropic compression studies are due to the amount of work in the literature. Experimental AFM investigations are being used to investigate particle interaction. The scale of interest is to be carried out on a larger scale. The macroscopical soil particle analysis is to be carried out on a larger scale.
Available measurement techniques, processes, and limitations
<table>
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<tr>
<th>Technique</th>
<th>Sample Size</th>
<th>Destructive (D)/ Non-Destructive (ND)</th>
<th>Sample State</th>
<th>Measure</th>
<th>Inferred Descriptors</th>
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<td>Gas Adsorption</td>
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<td>D Dehydrated (freeze-drying/vacuum)</td>
<td>Adsorbed mass of condensed gas as a function of pressure</td>
<td>Cumulative distribution of the pore volume, specific surface</td>
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<td>Sample preparation/pore morphology and connectivity</td>
<td>Santamarina et al. (2002)</td>
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<td>Mercury Intrusion Porosimeter</td>
<td>ca 1g</td>
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<td>3nm – 1mm</td>
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<td>Scanning Electron Microscopy</td>
<td>ca 1g</td>
<td>D Dehydrated (freeze-drying/oven)</td>
<td>Detection of secondary electrons</td>
<td>Image of the sample surface</td>
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<td>Sample preparation, essentially 2D</td>
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<td>Environmental Electron Scanning Microscopy</td>
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<td>Natural State</td>
<td>Detection of secondary electrons</td>
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<td>Cryo-Scanning Electron Microscopy</td>
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<td>Detection of secondary electrons</td>
<td>Image of the sample surface</td>
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<td>Confocal Laser/Electron Microscopy</td>
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<td>ND</td>
<td>Hydrated</td>
<td>Spectroscopy/Imaging</td>
<td>Pore Distribution</td>
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<td>~1 μm (lab)</td>
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5. Conclusions

[content of the 5. Conclusions section]

6. References

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An integrated pore size distribution

A particle


Rand, B., Pekenc, E., Goodwin, J. W. & Smith, R. W. 2017g. Investigation into the existence of edge face coagulated montmorillonite suspensions.


Rand, B. & Melton, I. E. 2017l. Investigation into the existence of edge face coagulated montmorillonite suspensions.


