

Time Effects on Strength and Deformation Characteristics of Gypsum Mixed Clay



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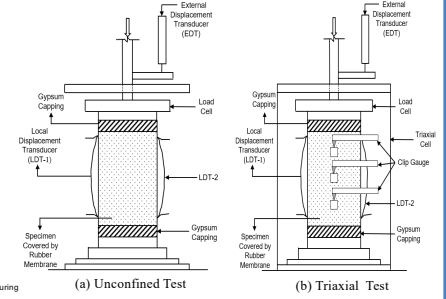
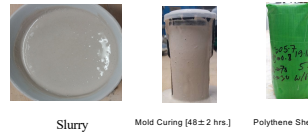


Introduction

- Approximately 1.6-1.7 million tons of gypsum plasterboards waste are generated annually in Japan and disposed to the landfills which have become a serious problem due to its high disposal cost, limited land, generation of hydrogen sulphide gases and release of fluorine.
- As a prospective solution, researchers in Japan have recently started to use recycled gypsum produced from these undesirable gypsum plasterboards waste in soil improvement applications.
- However, the time effects (ageing and loading rate effects or viscous effects) on the strength and deformation characteristics of gypsum mixed geomaterials are not extensively investigated till now. Therefore, in the present study, an attempt has been made to investigate the time effects on the mechanical behaviors of gypsum mixed clayey soil.

Materials and Methods

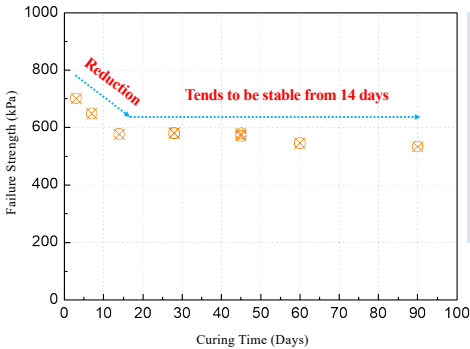
Mix Proportion by dry weight	
DL Clay	24.64 %
Kaolin	10.56 %
Gypsum	28.2 %
Water	36.6 %



Schematic illustration of specimen setting

Effects of Curing Time on Gypsum Mixed Clay (GMC)

- To investigate the effect of curing time on the mechanical behavior of GMC, specimens were tested under strain controlled at a strain rate of 0.02%/min at different curing periods, ranging from 3 ± 0.5 days to 90 ± 0.5 days.

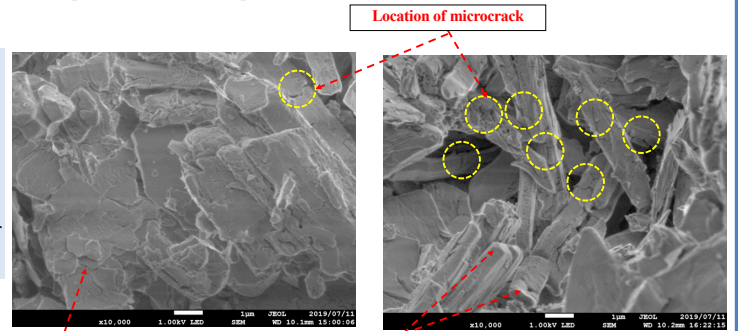


Effect of curing time on failure strength of GMC

FINDINGS

- ✓ Failure strength decreases with curing time, finally becomes stable after 14 days of curing.
- ✓ Formation of microcrack increases with curing time which is possibly responsible for the reduction of strength of GMC.

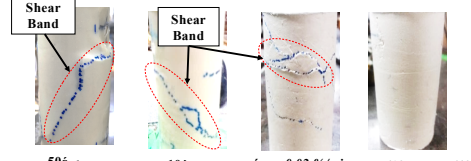
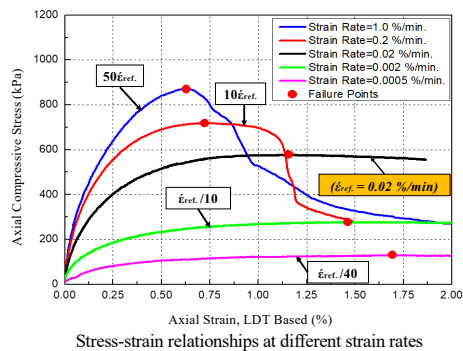
- To find out the reason behind the reduction of strength of GMC with curing time, Scanning Electron Microscopy (SEM) analysis was performed.



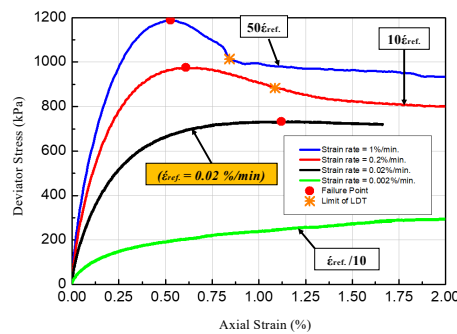
SEM images of GMC

Effects of Loading Rates on Gypsum Mixed Clay (GMC)

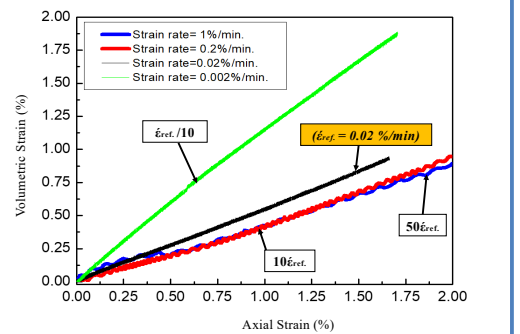
- To investigate the effect of loading rates on the mechanical behavior of GMC, specimens were cured for 28 ± 0.5 days and tested under several strain rates in both unconfined and confined (or triaxial) loading conditions.



Failure patterns at different strain rates
Behavior of GMC under several strain rates in **unconfined loading condition (0 kPa confining pressure)**



Failure patterns at different strain rates
Behavior of GMC under several strain rates in **confined loading condition (400 kPa confining pressure)**



Conclusions

- The **strength** of the GMC specimen **initially decreases** with curing time and finally **becomes stable** after 14 days of curing.
- Formation of **microcracks increases** with curing time which is possibly responsible for the **reduction of strength** of GMC.
- **Loading rate affects** the **failure strength, pre-peak stiffness, and failure strain** of GMC specimens in both unconfined and confined loading conditions.