

CEEN 043 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 4
Cement Hydration and Fly Ash Mortar

OBJECTIVE: To monitor the heat of hydration and correlate to gain in compressive strength of cement mortar and to evaluate the effects of the water/cementitious materials ratio and curing conditions for fly ash mortars.

EQUIPMENT: Mixing apparatus, scales, molds, thermometers.

ASTM REF: C 109, C 1074

PROCEDURE: **Part A: Cement Hydration**

- 1a. Prepare a mixture of sand and cement following the mix proportions provided and thoroughly dry mix. Prepare a mixture of water and admixture following the mix proportions provided and thoroughly mix. Immediately prior to mixing, record the temperature of the water and liquid admixture to the nearest 0.5 °C. Record the time at the start of mixing and thoroughly mix all ingredients until a homogenous cement mortar is attained.
- 2a. Transfer mortar into a paper cup and immediately place into the insulated holder. Insert a protected iButton into the mortar to record the temperature and time after mixing.
- 3a. Continue recording the temperature of the mortar at 15 minute intervals for the first 48 hours of curing.
- 4a. Completely fill a second paper cup with the excess mortar, taking care to ensure that all air is expelled from the mortar. Obtain the weight of the filled cup and place in the insulated curing chamber.
- 5a. Obtain the compressive load to failure, in pounds, of the molded mortar after 24 hours of curing.

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Part B: Fly Ash Mortars

- 1b. Prepare a mixture of sand, cement, and fly ash following the mix proportions provided and thoroughly dry mix. Add water following the mix proportions provided and thoroughly mix.
- 2b. Completely fill three paper cup molds, taking care to ensure that all air is expelled from the mortar. Obtain the weight of each filled cup and place in the specified curing environment.
- 3b. Repeat Steps 1 and 2 for a control mix (0% Fly Ash).
- 4b. Determine the mass, dimensions, and compressive load to failure, in pounds, of the mortar specimens after 7 days of curing.

Report:

1. From the time/temperature data obtained in Part A, prepare a calorimetry plot illustrating Temperature ($^{\circ}\text{C}$) vs Curing Time (hrs) for each mortar. Determine the area under the Temp-Time curve for each mortar and prepare a plot of 1-day compressive load vs area under the Temp-Time curve.
2. From the data obtained in Part B, prepare a plot of compressive load vs $^{\circ}\text{C}$ -Days of curing for each mortar mixture.
3. Comment on the results of Parts 1 and 2 above. Also, comment on the 7-day mass and dimensions of the mortar specimens as compared to those obtained after mixing.

