Chemical Admixtures in Concrete Spring 2015 MSE 597 (1.5 credit hour)
Tuesdays, 3:00-4:15 pm (ARMS 1103) with Prof. Kendra Erk

Reference book: *Concrete: Microstructure, Properties, and Materials*, by P. K. Mehta and P. J. M. Monteiro (4th edition available online through Purdue Library)

Course purpose: To provide upper-level undergraduate and graduate students in Materials Engineering and Civil Engineering with a mechanistic-level understanding of the performance of chemical admixtures in cementitious mixtures, with a focus on the structure-property relationships of the admixtures and their impact on the processing-structure-property relationships of fresh cement paste and hardened concrete.

Learning objectives: By the end of this course, the students will be able to:

- Identify and explain the different general types of chemical admixtures in concrete and describe how the different admixtures affect the processing, structure, and properties of fresh cement and hardened concrete (Bloom's 1,2)
- Identify and describe the chemical and physical structures of different chemical admixtures and predict how the admixtures will interact with cementitious mixtures, including interactions with other chemical admixtures (1,2,4)
- Critique and evaluate research related to new types of chemical admixtures in cementitious mixtures (4,5)
- Design a blend of admixtures to achieve a desired level of performance (4, 5,6)

Topics:

- Overview – concrete and cement basics and different classes of admixtures, chemical and mineral
- Admixtures related to concrete workability: superplasticizers/water-reducing admixtures
- Admixtures related to internal curing: superabsorbent hydrogels
- Admixtures related to microstructure refinement: air-entraining and shrinkage-reducing agents
- Mineral admixtures
- Admixtures related to hardened concrete performance: phase change materials and sealants
- Interactions between different chemical admixtures
- New chemical admixtures

Structure: one 75-minute lecture a week, led by Prof. Erk; lectures will include in-class activities and assessments, discussion of homework problem sets, and student presentations.

Grading: one 75-minute exam (40%), homework and participation (30%), in-class presentations (30%)

Course Assessment: (1) first lecture survey, to determine baseline knowledge of students and specific topics/areas of interest; (2) mid-semester survey; (3) end-of-semester survey