

Automated Foam Index Testing: A Quantitative Approach to Measure the Capacity and Dynamics during Air Entraining Agent Uptake

John M. Stencel¹, Melissa P. Ochsenbein¹ and Federico Cangialosi²

¹Tribo Flow Separations, 1525 Bull Lea Road, Suite 10, Lexington, KY 40511

² Department of Environmental Engineering and Sustainable Development, Technical University of Bari, viale del Turismo 8, 74100 Taranto, Italy

KEYWORDS: foam index, surface tension, air entraining agents

ABSTRACT

It is shown that by automating foam index measurements it is possible to acquire quantitative uptake capacities and the interaction dynamics during absorption of air entraining agents (AEA) onto pozzolanic and cementitious materials like combustion fly ash, fume silica and cement. Automation includes the addition of water and AEA, the measurement of bubble stability after intense agitation of mixtures, the identification of the foam index value, and finally the draining and cleaning of a sample cell to make it ready for the next test. Because this automated approach enables the real-time detection of bubbles as they burst, it became possible to compare bubble stability after titrating AEA into cement-ash mixtures with the corresponding changes in surface tension of the liquid covering the mixtures. These tests showed that the generation of bubbles and their stability were correlated, in part, to changes in liquid layer surface tensions. Furthermore, by mathematically modeling the foam index curves the changes in bubble stability could be related to changes in surface tension and interactions between the AEA and the unburned carbon and free-calcia within ash-cement mixtures.

Submitted for consideration in the World of Coal Ash 2009 Conference, held May 4-7, 2009.