34 *Egypt. J. Chem.* **59**, No. 4, pp. 573- 595 (2016)

Effect of Nanosilica on the Hydration Characteristics and Compressive Strength of Blended Basalt Cement Pastes

Kh. A. Khalil
Chemistry Department, Faculty of Science, Zagazig University, Zagazig, Egypt.

THE EFFECTS of nanosilica (NS) on the hydration kinetics and mechanical strength development of blended basalt cement pastes of cementitious mixes were investigated. The measurements have been carried out on blended basalt cement pastes made with four dose levels of NS at different water to binder ratios. NS accelerates the hydration of blended basalt cement pastes. The addition of NS improves the mechanical strength and increases combined water contents, but free lime and bulk density decrease. Basalt acts as filled materials at early age and then its reactivity increases due to pozzolanic reaction. It has been concluded that partial substitution of blended basalt cement pastes up to 4 mass % NS improves the mechanical and hydration characteristics in comparison with the control hardened pastes up to 90 days. The results can be mainly attributed to the ultrafine nature of NS. The phases formed have already been confirmed with XRD and DTA.

Keywords: Nanosilica, Basalt, Blended cement, Pozzolanic properties, Compressive strength.

The purpose of nano particle addition in cements is to stimulate the nucleation process during the early cement hydration. The earlier these nuclei are formed, the earlier they can grow to larger crystals of hydration phases and thereby accelerate the cement hydration. Due to the small size of nano particles, they provide very large surface areas. At the same time, these surfaces are so highly reactive that they may react with components from pore solution or may act as a nucleation site. The nano particle has also a large potential to react with components of the cement to form additional nuclei, like SiO_2 particles in a pozzolanic reaction to form calcium silicate hydrates (C-S- H) [1-6].

Nano silica (NS) has showed a high pozzolanic reactivity in fresh and hardened states. In the fresh state, it has been found that, NS reduces setting times, increases the release of hydration heat, and modifies the rheological behavior of cement pastes and mortars [7-17].

E-mail address; khalilali9@gmail.com* Tel.:+201110808356, 020552353628