

## **The Seventh Article**

### **Number (15) In The List of Total Publications**

Mohamed Heikal<sup>a</sup>, **S. Abd El Aleem**<sup>b</sup>, W.M. Morsi<sup>c</sup>, “Characteristics of blended cements containing nano-silica”, Housing & Building National Research Center (HBRC) Journal; (9) (2013), pp. 243–255.

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#### **Abstract**

The aim of the present work is to evaluate the effect of nano-silica (NS) on physicochemical, compressive and flexural strengths of OPC-granulated slag blended cement pastes and mortars. Different mixes were made with various amounts of NS, OPC and granulated blast-furnace slag (GBFS) and hydrated for 3, 7, 28 and 90 days. The hydration behavior was followed by estimation of free lime (FL) and combined water contents at different curing ages. The required water for standard consistency, setting times and compressive strength was also determined. The results obtained were confirmed by XRD, DTA, IR and SEM techniques. The required water for standard consistency and setting times increase with NS content, due to the presence of 1% of superplasticizer. As the NS content increases the values of both FL and pH decrease. The compressive and flexural strengths of cement mortars containing NS are higher than those of control OPC–GBFS mix (M3). As the NS content increases above 4 mass%, compressive and flexural strengths of OPC–GBFS–NS blends decrease but still more than those of the control samples (M3). The results of XRD, DSC, IR and SEM examinations are in good harmony with each other and with chemical analyses. The composite OPC–GBFS–NS cements containing 45 mass% of GBFS and

3–4 mass% of NS possess the highest improvement of mechanical properties, hydration kinetics and microstructure of hardened cement pastes and mortars.