Influence of superplasticizer doped by Nano-silica on the rheological and mechanical properties of cement mortars

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Abstract

Previous research indicates that the inclusion of nanosilica (NS) modifies the properties of the fresh and hardened state, compared to the traditional mineral additions. Some authors estimate that the appropriate percentage of Nano-silica should be small because of difficulties caused by agglomeration to particles during mixing, while others indicate that 10% by weight, if adjustments are made to the formulation to avoid an excess of self-drying and micro cracks that could impede strength. For this purpose, the present work aim to see the effect of the introduction mode of the nanosilica on the rheological and physic mechanical properties of cement mortars. In this study, NS was used either powdered with cement or in solution with the superplasticizer (Superplasticizer doped in nanosilica figure (a)). Results show that the use of nanosilica powder (replacing cement on the one hand) has a negative influence on the rheological parameters and the rheological behavior of cementitious pastes. However, the introduction of nanosilica in solution in the superplasticizer (SP) was significantly improved the rheological parameters and the rheological behavior of cementitious pastes. Indeed, more the dosage of NS-doped SP increases more the shear stress and viscosities of the cementitious pastes become more fluid and manageable. A significant reduction of shear stress and plastic viscosity were observed that due to the increase in superplasticizer. A dosage of 1.5% NS-doped SP gave adequate fluidity and the shear rate was lower.

Keywords: Nano-silica, superplasticizer, mortar, rheological properties, mechanical properties..

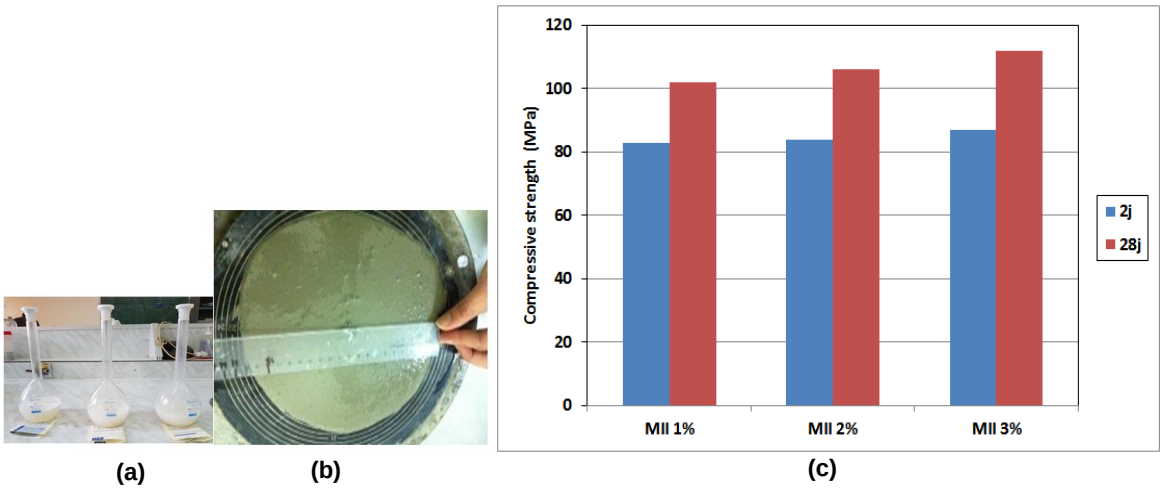

Figure Compressive strength of cement mortars with superplasticizer doped by Nanosilica
(a) Superplasticizer doped by NS (b) Fluidity of mortar (c) Compressive strength evolution

References

1) Kawashima, S., Hou, P., Corr, D. J., & Shah, S. P. (2012), Modification of cement-based materials with nanoparticles, Cement and Concrete Composites, 36, 8–15.
2) Kong, D., Du, X., Wei, S., Zhang H., Yang, Y., Shah, S. P. (2012) Influence of nano-silica agglomeration on microstructure and properties of the hardened cement-based materials. Construction and Building Materials, 37: 707–715
3) Stefanidou, M. 2012 Influence of nano-SiO2 on the Portland cements pastes. Composites Part B: Engineering, 43, 2706–2710.
4) Qing, Y., Zenan, Z., Deyu, K., & Rongshen, C. (2007) Influence of nano-SiO2 addition on properties of hardened cement paste as compared with silica fume. Construction and Building Materials, 21, 539–545.