Revista Romana de Materiale/ Romanian Journal of Materials 2017 vol.47 N4, pages 484-490

Influence of the calcined light loam on the properties of the hardened portland cement paste

Rakhimova N., Rakhimov R., Gaifullin A., Morozov V. Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2017, Fundatia Serban Solacolu. All rights reserved. The increasing worldwide production of Portland cement and demand to reduce CO 2 emissions has resulted in the need to increase the volume and varieties of supplementary cementitious materials. The most promising source of raw materials for the production of supplementary cementitious materials is ubiquitous and unlimited reserves of polymineral clays. In this article the effect of calcined loam clays depending on its concentration, calcination temperature (400-800°C), and specific surface area (250-800 m 2 /kg) on the properties of Portland cement is studied. It is found out the calcined loam clays increase the compressive strength of Portland cement hardened paste up to 35%, density up to 1.4%, water resistance from 0.92 to 0.93-0.97, and decrease the water adsorption from 1 to 0.9%. The reasonability of production and application of calcined loam clays, which aren't lower in efficiency than high-priced metakaolin, is stated.

Keywords

Calcination, Compressive strength, Density, Light loam, Metakaolin, Portland cement paste, Pozzolana

References

- [1] Rio Declaration on Environment and Development and Agenda 21. First United Nations Conference of Environment and Development, Rio De Janeiro. 3-14 June. 1992.
- [2] R.Z. Rakhimov, Y.C. Magdeev, V.N. Yarmakovsky, Ecology, acientific achievements and innovations in production of building materials on the base and with application of raw materials of technogenic origin, in Proceedings of International Congress of Science and Innovations in Building Construction, Voronezh, May 2008 (VGASU, Voronezh, 2008), pp. 441-448
- [3] H.M. Ludwig, CO-arme Zemente für nachhaltige Betone in Proceedings of 19.Internationale Baustofftagung "Ibausil", Weimar, September 2015, edited by H.B. Fischer, C. Boden, and M. Neugebauer, (Finger-Institute, Weimar, 2015) pp. 7-32.
- [4] N.I. Afanasieva, Current state on mineral source base of pozzolanic materials for cement production, Cement and its Application, 2015, v. 4, pp. 32-34
- [5] A.M. Rashad, Metakaolin as cementious material: History, scours, production and application-A comprehensive overview, Construction and Building Materials, 2013, 41, 303.
- [6] V. Aksenov, Glinite-cement. Moscow: Building literature, 1935
- [7] B.Y. Gorbachev, in Proceedings of International conference «Industrial minerals», Kazan, November 2015, pp.111-114
- [8] C. He, E. Makovicky, S. Osbaeck, Thermal stability and pozzolanic activity of calcined illite, Applied Clay Science, 1995, 9(34), 337.

- [9] R. Fernandez Lopez, PhD thesis, Calcined Clayey Soils Developing Countries, Ecole Polytechnique federal de Lausanne, Lausanne, 2009.
- [10] R. Fernandez, F. Martirena, K.L. Scrivener, The origin of the pozzolanic activity of calcined clay minerals: A comparison betw?en kaolinite, illite and montmorillonite, Cement and Concrete Research, 2001, 41(1), 113.
- [11] P. Pardo, P.V. Christensen, Kading K, Surface properties of calcined clays and their dispersion in blended Portland cement pastes, in Proceedings of XIII International Congress on the chemistry of cement, Madrid, July 2011, edited by A. Palomo et al. p. 51.
- [12] Y.C. Floze, C.C. Cordeiro, A.M. Tavares, Pozzolanic Activity of Selected Mineral Admixtures at Different Grind Sizes, in Proceedings of XIII International Congress on the chemistry of cement, Madrid, July 2011, edited by A. Palomo et al. p.133.
- [13] A. Tironi, M.A. Trezza, A.N. Scian, Assessment of pozzolanic activity different calcined clay, Cement and Concrete Composites, 2013, 37, 319.
- [14] N. Gard, J. Skibsted, Thermal activation of a pure montmorillonite clay and its reactivity in cementations systems, Journal of Physical Chemistry C, 2014, 118, 11464.
- [15] G. Nishant, D. Zhuo, K. Enemark-Rasmussen, Pozzolanic reactivity of thermally activated kaolinite and montmorillonite in Portland cement blends and their impact on the formed C-H-S Phase, in Proceedings of XIII International Congress on the chemistry of cement, Madrid, July 2011, edited by A. Palomo et al. p.221.
- [16] R.K. Mehta, Studies of blended cement containing Santorin earth, Cement and Concrete Research, 1986, 11(4), 507.
- [17] J. Pera, J. Ambrouse, A. Messi, Pozzolanic activity of calcined laterite, Silicate Industrial Ceramic Science Technology, 1998, 63 (7-8), 107.
- [18] T. Ostnor, H. Justnes, T. Martius-Hammer, Calcined marl as alternative pozzolan, in Proceedings of 7 th Central European congress on Concrete Engineering, Balatonfured, 2011, 151.
- [19] R. Fernandez, R. Vigil Delavilla, R. Gazsia, Characterization and pozzolanic activity of a calcined natural zeolite, in Proceedings of XIII International Congress on the chemistry of cement, Madrid, July 2011, edited by A. Palomo et al. p.100.
- [20] A.A. Guvalov, T.V. Kuznetsova Influence of ash zheirangelskogo deposit on the properties of the blended cements, Tecnhique and Technology of Silicates, 2013, 20(30), 2.
- [21] S.C. Taylor-Lange, E.L. Lamon, K.A. Riding, Calcined kaolinitebentonite clay blends as supplementary cementitious materials, Applied Clay Science, 2015, 108, 84.
- [22] N. Gard, J. Skibsted, Pozzolanic reactivity of calcined interstratified illite/smectite (70/30) clay, Cement and Concrete Research, 2016, 79, 101.
- [23] Rakhimov RZ, Rakhimova NR, Gaifullin AR. Influence of the addition of fine-dispersed polymineral calcined clays on the properties of Portland cement paste. Advances in Cement Research, 2017, 29(1), 21.
- [24] R.Z. Rakhimov, N.R. Rakhimova, A.R. Gaifullin, V.P. Morozov, Properties of Portland cement pastes enriched with addition of calcined marl, Journal of Building Engineering, 2017, 11, 30.
- [25] A.R. Gaifullin, R.Z. Rakhimov, N.R. Rakhimova, The influence of clay additives in Portland cement on the compressive strength of the cement stone, Magazine of Civil Engineering, 2015, 7, 7366.
- [26] A. Tironi, A.N. Scian, E.F. Irassar, Hydration of cements elaborated with limestone filler calcined kaolinitic clay, in Proceedings of XIV International congress on the chemistry of cement, Beijing, October 2015, edited by C.Shi et al. p. 703.
- [27] A. Trümer, H.M. Ludwig, Special durability issues of concretes made with composite cements containing clays, in Proceedings of 19.Internationale Baustofftagung "Ibausil", Weimar, September 2015, edited by H.B. Fischer, C. Boden, and M. Neugebauer, (Finger-Institute, Weimar, 2015) pp. 0627-0634.
- [28] A. Trumer, H.M. Ludwig, The application of cements incorporated with calcined clays for durability improvement of concretes, Cement and its Application, 2016, 3, 71.
- [29] Proceedings of 1st International Conference on Calcined Clays for sustainable Concrete, Losanna, 2015.
- [30] B. Lottenbach, K.L. Scrivener, R.D. Hooton, Supplementary cementitious materials, Cement and Concrete Research, 2011, 41, 1244.
- [31] N.R. Rakhimova, R.Z. Rakhimov, A review on alkali-activated slag cements incorporated with supplementary materials, Journal of Sustainable Cement-Based Materials, 2014, 3(1), 61.
- [32] V.K. Kozlova, A.M. Mahocha, V.P. Skakun, E.Y. Malova, E.V. Bojek, The features of hydration products of blended Portland cements introduced with mineral carbonate additives, Cement and its Application, 2014, 4, 102.