Materials Science Forum
ISSN: 1662-9752, Vol. 968, pp 96-106
doi:10.4028/www.scientific.net/MSF.968.96

Submitted: 2019-05-11
Accepted: 2019-05-29
Online: 2019-08-23

Study of Rheological Properties of Modified Concrete Mixtures at Vibration

Oleksandr Pshinko[1,a], Olena Hromova[2,b], Dmytro Rudenko[3,c*]

[1]Rector of Dnipro National University of Railway Transport named after Academican V. Lazaryan, Lazaryan Str., 2, 49010, Dnipro, Ukraine, tel. +38 (056) 373 15 46

[2]Associate Professor of Department «Project management, building and construction materials» of Dnipro National University of Railway Transport named after Academician V. Lazaryan, Lazaryan Str., 2, 49010, Dnipro, Ukraine, tel. +38 (056) 373 15 46

[3]Associate Professor of Department «Grafics» of Dnipro National University of Railway Transport named after Academician V. Lazaryan, Lazaryan Str., 2, 49010, Dnepr, Ukraine,

tel. +38 (056) 373 15 46

[a]e-mail: Pshinko@mail.diit.edu.ua, [b]e-mail: ELEANAGROMOVA@GMAIL.COM, [c]e-mail: veberc@ukr.net

Keywords: modified concrete mixture, rheology, viscosity, thixotropy

Abstract. Study of rheological properties of concrete mixtures based on modified cement systems in order to determine process parameters. **Methodology.** To study structural-mechanical properties of modified concrete mixtures of different consistency at their horizontal vibrating displacement an oscillatory viscometer was designed. **Results**. The optimization of the process of vibration displacement of concrete mixtures with the specification of parameters of vibration impacts taking into account structural-mechanical properties of the mixture is performed. It has been established that the viscosity of the modified cement system of the concrete mixture is a variable quantity, which depends on the parameters of the vibration impacts. **Scientific novelty.** The mechanism of interaction of the modified concrete mixture with the form and the table vibrator during its vibration compaction is determined. On the basis of this, a model of concrete laying process control is proposed, that allows to predict the ability to form a dense concrete structure. **Practical significance.** Disclosed physical nature of the process of vibrating displacement of modified concrete mixtures using the principles of physical-chemical mechanics of concrete allows reasonably choose the best options for vibration impacts.

Introduction

To develop the modes of movement and delivery to the place of deposit of the modified concrete mixture, it is necessary to investigate its rheological properties. The main characteristic of rheological properties is viscosity [2, 3, 14-16].

The viscosity of the modified cement system can be represented as the force acting per unit area of the layer which is shifted (shear stress), required to maintain a constant velocity gradient between two parallel layers located at a constant distance from each other [2, 3].

The viscosity of the modified cement system significantly differs from the intrinsic fluid viscosity [6-8, 10, 20-22]. While the intrinsic viscosity of the fluid remains constant at a given temperature and current shear stresses, the viscosity of the cement system may change even at a constant temperature depending on the shear stress or shear-strain rate. Under the influence of external forces, the bond between individual elements of the cement system deteriorates, and its ability to plastic deformation increases [1, 4, 5, 9, 17]. The system is diluted, and its mobility increases. At a certain critical shear rate, the initial structure of the cement system virtually collapses completely. The viscosity and shear strength reach the minimum values and the system becomes fluid. When the external actions cease, the cement system returns to its original state, its