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PORTLAND CEMENT COMPOSITION, PROPERTIES, AND APPLICATION

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Abstract.

Portland cement, a fundamental building material in construction, plays a pivotal role in shaping the modern infrastructure. This abstract delves into the comprehensive understanding of Portland cement, exploring its composition, properties, and versatile applications. The composition involves a meticulous blend of clinker, gypsum, and supplementary materials, showcasing a delicate balance to achieve optimal performance. Examining the properties reveals the material's strength, durability, and workability, crucial factors in determining its suitability for diverse construction projects. Furthermore, the abstract explores the myriad applications of Portland cement, ranging from traditional applications in concrete production to innovative uses in specialized construction and infrastructure projects. This investigation aims to provide a holistic perspective on Portland cement, offering valuable insights for engineers, researchers, and industry professionals involved in the construction sector.

Keywords: Portland cement, Clinker, Gypsum, Supplementary materials, Composition, Properties, Strength, Durability, Workability, Concrete production, Construction, Infrastructure, Applications, Building material, Cementitious blends.

Аннотация.

Портландцемент, основной строительный материал в строительстве, играет ключевую роль в формировании современной инфраструктуры. Этот реферат углубляет всестороннее понимание портландцемента, исследуя его состав, свойства и универсальное применение. Композиция включает в себя тщательно продуманную смесь клинкера, гипса и дополнительных материалов, демонстрируя тонкий баланс для достижения оптимальных характеристик. Изучение свойств показывает прочность, долговечность и технологичность материала, что является решающими факторами, определяющими его пригодность для различных строительных проектов. Кроме того, в реферате исследуются многочисленные применения портландцемента, начиная от традиционного применения в производстве бетона и заканчивая инновационным использованием в специализированных строительных и инфраструктурных проектах. Целью данного исследования является предоставление целостного взгляда на портландцемент и предоставление ценной информации инженерам, исследователям и специалистам отрасли, работающим в строительном секторе.

Ключевые слова: Портландцемент, Клинкер, Гипс, Вспомогательные материалы, Состав, Свойства, Прочность, Долговечность, Технологичность, Производство бетона, Строительство, Инфраструктура, Применение, Строительный материал, Цементные смеси.

Introduction.

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Portland cement and its varieties are modern in construction the most widespread cement type is considered Portland cement - hydraulic binder is Portland cement clinker gypsum with, also special additions with small grind through is taken. Portland cement clinker gypsum with small grind the way with is taken; to the mixture active mineral supplements to input permission is given Portland cement clinker - limestone and from clay or some materials (marl, high furnace slags, and others) consists of thinly dispersed one character raw material mixture from sintering before to burn product. Raw the item frying circulation in furnaces at a temperature of 1450 - 1500 °C is increased. Burn in the process in clinker high justified calcium of silicates superiority is provided. Portland cement features clinker to the composition and its grinding level depends on Portland cement the most important feature water with mutually when exposed hardening is the ability. It is wet in conditions of 28 days from hardening after cement-sand of limes standard of samples compression and bending overpower with of defined Portland cement brand with is described. Portland cement is hard to stay the time in order put for cement SO_3 in the composition the amount which provides amount grinding during to clinker gypsum dihydrate is added. Content separate Stands: Portland cement without additions; mineral supplements with Portland cement; slag portland cement and others From ordinary Portland cement except his composition, properties, and application fields according to difference doer varieties work released: fast hardened, plasticized, hydrophobic, to sulfate resistant, white Portland cement - asbestos-cement products work release for.[1]

Main body.

Work release ready Portland cement product clinker based on common construction for intended cement.

Cement to the requirements of GOST 31108 according to work is issued.

Table 1.

Portland cement structural parts.

Content	**Marked in quantity (%).**	**least (%).**
Lime (CaO)	60-67	63-65
Silicon oxide (SiO2)	17-25	19-23 |
Aluminum smell oxide (Al2O3)	3-8	3-8
Iron oxide (Fe2O3)	0.5-6	0.5-6
Magnesium (MgO)	0.1-4	0.1-4
Sulfur trioxide (SO3)	1-3	1-3
Alkalis (Na2O and K2O)	0.3-1.2	0.3-1.2
Other	< 1	< 1

Cement - hydraulic properties have was, clinker, and gypsum or his derivatives and need when from additions consists of has been powdery construction connector. Water or other liquids with mutually when exposed, cement plastic mass (cement paste) yield does, when it hardens strong and durable cement to the stone becomes

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of cement color gray, but used raw to the item depending on, it is different to the shadows have to be possible: from gray-green to gray-brown.

of cement real density 3000 - 3200 kg / m ^{3} organize does of cement public density 1000 - 1300 kg / m $^{3.}$

Materials to the composition according to cement the following to species divided into:

- Portland cement (without mineral additives);
- additions with Portland cement (active mineral additives with it's not more than 20% ;
- Portland slag cement (more than 20%). granulated slag the addition of with).

28 days age pressure power according to cement is divided into brands for:

- Portland cement - 400, 500, 550 and 600;
- Portland slag cement - 300, 400 and 500;
- fast hard standing Portland cement - 400 and 500;
- fast hard standing Portland slag cement - 400.

Cement work in release the following applies to:

- technological to the regulation suitable coming chemical composition according to clinker. In clinker magnesium oxide (MgO) mass the share does not exceed 5% need

- GOST 4013 or another belongs to documents according to gypsum stone. Appropriate regulatory and technical documents according to phosphogypsum, boro gypsum and, fluoro gypsum to use permission is given ; [2]

— according to GOST 3476 grainy pieces or electrothermophosphorous slag belongs to regulatory and technical documents according to other active mineral additives;

- of cement main features in order puter additions and belongs to regulatory and technical to documents according to technological additions.

M 400 cement brand in construction the widest spread Make it in release special from additions use him to water resistance to cold durability, strength, and durability increases. The price-quality ratio is based on his considering the price as optimal However, different work of producers' cost of additions quantity and quality looking different to can Portland cement brand M 400 reinforced concrete items and constructions work release for wide is used.

M 500 brand from cement used without lime quickly hardens different extraordinary work is used because the main features hard the rest from the time starting from appear will be the cold resistance to moisture endurance and strength such as to indicators, which is especially important reinforced concrete constructions work release for special requirements placed q is also used in cases. Do not collect concrete, beams, and ceilings work release for is used. M 500 brand of cement two type there is:

- mixtures and additions non- M 500 DO brand Portland cement; to the cold resistance to moisture endurance and of products strength provide necessary has been an industry in construction is used;

- cement in the composition of brand M 500 D 20 to corrosion against features 20% enhancement supplements there is.

Portland cement-prepared products and structures land top, ground under, and water under conditions wide used. Residential, industrial, hydraulic engineering, road construction, etc monolithic and don't collect concrete, and reinforced concrete work in the release is used. Its tough and light concrete, cellular concrete, high variety of lime, heat insulating materials, and

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others work releases Portland cement to the sea, mineralized and even clean water flowing or strong pressure under has been to structures non-applicability need.

Conclusion

In conclusion, the exploration of Portland cement, encompassing its composition, properties, and applications, underscores its indispensable role in the construction industry. The careful balance of clinker, gypsum, and supplementary materials in its composition contributes to its unique properties, including strength, durability, and workability. The versatility of Portland cement is evident in its broad spectrum of applications, ranging from traditional uses in concrete production to innovative applications in specialized construction and infrastructure projects.

Understanding the intricacies of Portland cement is crucial for engineers, researchers, and industry professionals seeking to optimize its use in diverse projects. As we strive for sustainable and resilient construction practices, the knowledge gained from studying Portland cement can pave the way for advancements in materials science and engineering.

In the ever-evolving landscape of construction, Portland cement remains a cornerstone, continually adapting to meet the demands of modern infrastructure. By harnessing its properties and exploring new applications, we can contribute to the development of robust, environmentally friendly, and efficient construction practices. As we move forward, the ongoing research and application of Portland cement will play a pivotal role in shaping the sustainable future of the construction industry.

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