ECOMATERIAL TECHNOLOGIES
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TECHNICAL BULLETIN

Natural Pozzolans

Types & Benefits

ASTM International defines pozzolan as "a finely divided siliceous or siliceous and aluminous material that will not react chemically with water, but will react with calcium hydroxide and water at ordinary temperatures to form compounds possessing cementitious properties."

Pozzolans can be of different types and sources. They include Class F and Class C fly ash, which are products of the combustion of coal in large power plants. They also include natural pozzolans, which can be raw (e.g., volcanic ash and pumicite) or calcined (e.g., calcined shale and metakaolin).

Raw natural pozzolans are produced from rocks of volcanic origin, generally pyroclastics. These fast-cooling pyroclastic materials from explosive eruptions typically exhibit high pozzolanic activity. Some raw natural pozzolans can also be produced from biochemical sediments, such as diatomaceous earths. Regardless of the source, raw natural pozzolans must be mined and processed to the appropriate fineness to expose surface area and unlock their pozzolanic properties before they can be used as a supplementary cementitious material in concrete.

Calcined natural pozzolans are typically produced by thermally treating clays and shales. As raw natural pozzolans, these materials have to be mined and

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processed to the appropriate particle size. However, they additionally need to be thermally treated at temperatures that can range from 550°C to 850°C. At these temperatures, a dehydroxylation and formation of pozzolanic amorphous content occurs yielding a highly pozzolanic material.

Raw and calcined natural pozzolans impart a wide range of qualities to many types of concrete by:

- Effectively moderating concrete's heat of hydration, thereby making it an ideal cementitious material in mass concrete and high-strength mixes.
- Providing sulfide and sulfate resistance equal or superior to Type V cement. Class F fly ash and natural pozzolans are often recommended for use where concrete may be exposed to sulfate ions in soil and ground water.
- Reducing the risk of deleterious expansion and cracking in concrete due to alkali-silica reaction (ASR).
- Effectively reducing the permeability of concrete, thereby restricting the ingress of aggressive ions, such as chlorides, that can compromise durability.

Concrete manufacturers, engineers, architects, developers, and contractors all have an interest in specifying or using natural pozzolans on a routine basis to improve the quality of their project and to increase their cost-effectiveness.

READY-MIX PRODUCERS

Ready-mix producers have several reasons for using natural pozzolans in concrete, as they contribute to:

- A more predictable and consistent finished product that will ensure customer acceptance.
- Flexibility in mix design, providing the ability to proportion a wide range of mixes—from controlled low-strength material at 100 psi to high-strength (8,000-plus psi) concrete—produced by the same batch plant without exotic equipment.
- The ability to customize designs to each client's needs, thus providing the producer a competitive advantage.

ENGINEERS AND ARCHITECTS

Engineers and architects will find that natural pozzolans provide:

- A superior and more durable finished concrete.
- A high-strength concrete that accommodates the design of thinner sections.
- Design flexibility accommodating curves, arches, and other pleasing architectural effects.
- Built-in insurance for later-age strength gain in concrete.
- Assurance that the concrete will qualify as a durable building material.
- A valuable contribution to the aesthetic appearance of the concrete.
- Reduction in the embodied energy and carbon footprint of concrete, making concrete more sustainable.

DEVELOPERS, CONTRACTORS, AND OWNERS

Concrete containing natural pozzolan affords the following advantages to developers, contractors, and owners:

- Since concrete containing natural pozzolan is not as vulnerable to deterioration or disintegration as rapidly as concrete without natural pozzolan, it ensures low-maintenance buildings that will retain their value over the long term.
- Natural pozzolan in the mix accommodates more creative designs.

For more information or answers to questions about the use of fly ash in specific applications, contact your nearest Eco Material Technical Sales Representative or call 801-984-9400.

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