renca

Practical application of geopolymer binder systems for encapsulation of toxic and flammable recycled waste into sustainable and fireproof composites

Alex Reggiani

RENCA Inc (Joint Italian and Russian company)
GeoMits (Italy)

GeoMITS

RENCA team

Andrey Dudnikov

engineer, CEO

Andrey is a co-founder and CEO of Renca. Being an engineer he knows how the things should work. Having more than 10 years experience in construction materials production and R&D as well as in general management he can organize production of literally everything, from a needle to a space shuttle, but prefers creating sustainable construction materials that are game changing for the building industry.

Marina Dudnikova

economist, Business Development Director

Marina is BDD and co-founder of Renca. People think that construction industry is a man's business. Marina proves that it's not. She has more than 10 years experience in construction. She not only knows deeply the principles of construction as well as the technology and materials, but also cares about sustainability and green building's principles. On the other hand, Marina sees the picture from the financial perspective, making our products not only eco- but also cost-effective.

Alex Reggiani

geologist and mineralogist, CTO

Alex is CTO and co-founder of Renca. He is the data-base and creator of the breakthrough products that we have. He is a geologist-mineralogist by education and devotion and has more than 15 years experience in developing products that are used in almost every house today. He can create working recipes simply by looking at the test results of the materials at his disposal. Laboratory is his second home.
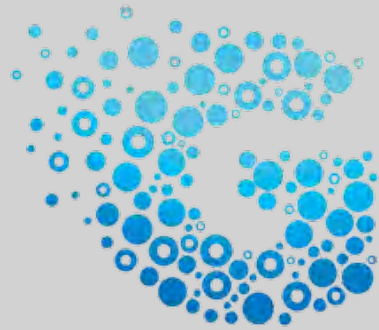
GEOMITS

OBJECTIVES OF THE PROJECT

1. **Toxic waste management**
(polystyrene bubbles, moldy cork, recycled glass etc.)
2. **Meet circular economy criteria**
(use of local wastes)
3. **Recycling and creation of new products**
(thermal insulation panels; fireproof and lightweight materials)

TECHNICAL PROPERTIES

OPC & RESINS   VS   GP BINDERS

- High cost
- Not eco-friendly
- Not fireproof

- Optimisation of costs
- User-friendly systems
- Fireproof ability

GEOPOLYMER BINDER SYSTEMS

- **Ferrosialate based** and sodium silicate reagent
- **White MK** based and potassium silicate reagent
- **Beige MK** based and potassium silicate reagent

RECYCLED AGGREGATES

- **Recycled polystyrene bubbles** (2-5 mm)
- **Coarse moldy cork** (3-8 mm)
- **Artificial expanded glass bubbles** (0,1-0,3; 2-4 mm)
- **Natural expanded glass bubbles** (0,1-0,3 mm)
- **Recycled micronozed glass** (less than 75 um)

Test results

Casting in polyurethane mold

Hardening time 90 - 180 minutes
Demolding after 24h
Mechanical checks after 7d and 28d
Room temperature hardening

Performances

Ferro-sialate/polystyrene bubbles
Density about 0,18 g/cm3 ,
Flexural Strength after 28 days = 1,1 MPa,
Compressive Strength after 28 days = not evaluated (too elastic)

White Metakaolin
Density about 0,16 g/cm3 ,
Flexural Strength after 28days = 0,75 MPa,
Compressive Strength after 28days = 0,85 MPa.

Beige Metakaolin Density about 0,18 g/cm3 ,
Flexural Strength after 28days = 2,6 MPa,
Compressive Strength after 28days = not evaluated (too elastic)

Performances

Ferro-sialate/artificial expanded glass
Density about 0,37 g/cm3 ,
Flexural Strength after 28 days = 2,1 MPa,
Compressive Strength after 28 days = 3,6 MPa

Ferro-sialate/artificial expanded glass and cork
Density about 0,3 g/cm3 ,
Flexural Strength after 28 days = 1,8 MPa,
Compressive Strength after 28 days = 2,5 MPa

Ferro-sialate geopolymer foam
Density about 0,35 g/cm3 ,
Flexural Strength after 28 days = 1,5 MPa,
Compressive Strength after 28 days = 2,6 MPa

Fireproofing testing

Thermal shock in cold water

Ferrosialate/ Polystyren bubbles

1h testing of fireproofing

Conclusions

- All GP Binder systems are useful for recycled materials;
- Only White MK based recipe was not optimised for this application because was too fluid (like water);
- Even very low density showed enough mechanical strength
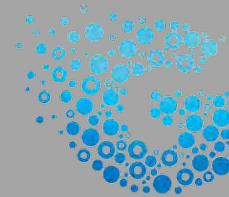- Fireproof ability confirmed by long testing

Thank you!

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