GRAPHENE IN CEMENT: SOLVING REAL-WORLD CHALLENGES

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GRAPHENE IN CEMENT – THE WORLD SCENARIO

- CEMENT CONTRIBUTES ~8% OF GLOBAL CO_2 EMISSIONS.
- DURABILITY AND EARLY-STAGE CRACKING ARE MAJOR CHALLENGES.
- GRAPHENE ADOPTION GROWING IN RESEARCH BUT NOT YET AT MASS SCALE.
- INDUSTRY DEMANDS SCALABLE, COST-EFFECTIVE NANOMATERIAL INTEGRATION.
- GAP: BRIDGING LAB INNOVATION AND SITE IMPLEMENTATION.

WHY GRAPHENE IS A GAME-CHANGER FOR CEMENT

- Highest mechanical strength material known (~1 TPa Young's modulus).
- Excellent water barrier properties due to layered structure.
- Acts as nano-reinforcement within C–S–H matrix.
- Accelerates cement hydration by acting as a nucleation site.
- Offers sustainability advantages by reducing clinker demand.

SCIENTIFIC & ENGINEERING BENEFITS

- **Crack Reduction:** Up to 40% fewer microcracks, better tensile strength.
- **Water Resistance:** 28–40% lower water permeability, chloride resistance.
- **Faster Curing:** 20–35% faster setting due to nucleation acceleration.
- **CO_2 Reduction:** 10–15% clinker reduction possible per mix.
- **Custom Formulations:** Effective in varied regional mix designs.

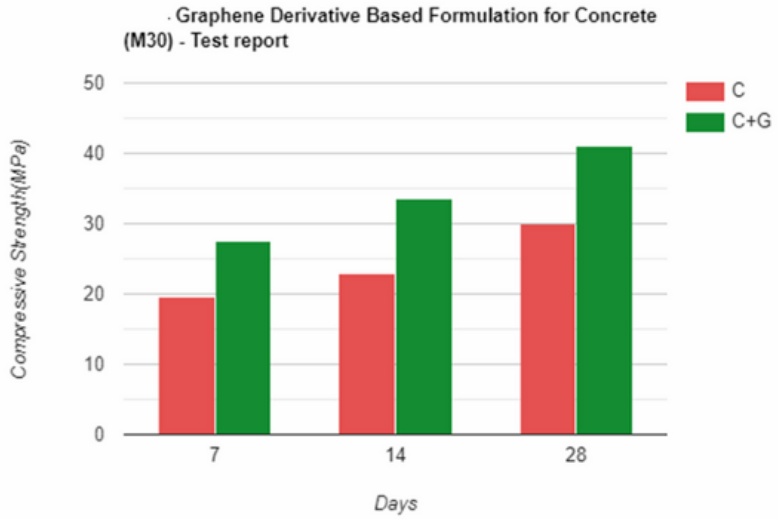
- Mass-scale graphene derivatives for cement enhancement.
- Over 5 tons/month production capability established.
- Formulated to blend with OPC, PPC, geopolymer, lime cement.
- Customized surface-treated graphene for dispersion stability.
- 10x cost advantage compared to conventional lab graphene.

RI GROUP'S SCALABLE GRAPHENE SOLUTION

USE CASES ACROSS INDUSTRY

- 🧱 INFRASTRUCTURE: BRIDGES, TUNNELS, HIGHWAYS.
- 🏗️ PRECAST: TILES, PAVERS, READY-MIX BLOCKS.
- 🌊 MARINE: COASTAL PROTECTION, PORT SLABS, SHIPYARDS.
- 🏠 HOUSING: LOW-COST DURABLE CONSTRUCTION.
- ♻️ GREEN BUILDING: LOWER CARBON CERTIFICATION POTENTIAL (LEED, IGBC).

EXAMPLE RESULTS (CERTIFIED)- TESTED AT THE CUSTOMER SITE



Graphene derivative based formulation for M 30 Concrete with cement reduction- with plasticiser

- Enhanced strength with 24% reduction in cement.
- Formulation with <0.001 wt% Graphene derivative used.
- 7th day compressive strength with Graphene based additive is 20% greater than 14th day of normal concrete.
- 37% increase in 28th day compressive strength with Graphene.
- Slump and workability was within the acceptable limits.

STRATEGIC INSIGHTS & VALUE ANALYSIS

COST STRUCTURE, ENVIRONMENTAL FOOTPRINT, AND REGULATORY POSITIONING

PART 1: CONSTRUCTION CHALLENGES VS. GRAPHENE-ENABLED SOLUTIONS

Construction Industry Challenge	Graphene-Enabled Solution	Impact/Outcome
High Cement Consumption	Graphene-enhanced concrete allows for **up to 30% reduction** in cement usage without compromising strength	📉 Lower material costs; reduced structural load
Limited Use of Industrial By-products	Improved binding properties enable incorporation of **fly ash, construction debris, and industrial sludges**	♻️ Waste reduction; cost savings on raw materials
Extended Construction Timelines	Accelerated curing times due to graphene's properties	⏱️ Faster project completion; labor cost savings
Durability and Maintenance Issues	Enhanced tensile and compressive strength, increased resistance to environmental factors	🛠️ Longer-lasting structures; reduced maintenance costs
Carbon Emission Regulations	Up to **40% reduction** in CO_2 emissions; eligibility for carbon credits	🌎 Compliance with regulations; potential revenue from carbon credits

🌱 PART 2: STRATEGIC BENEFITS FOR CONSTRUCTION PROJECTS

🔹 **Cost Efficiency**

•**Material Savings**: Reduced cement usage leads to significant cost reductions.

•**Waste Utilization**: Incorporation of industrial by-products lowers raw material expenses.

🔹 **Enhanced Project Timelines**

•**Faster Curing**: Accelerated setting times shorten construction schedules.

•**Labor Optimization**: Reduced labor hours due to quicker project turnaround.

🔹 **Sustainability and Compliance**

•**Lower Carbon Footprint**: Significant CO_2 emission reductions align with green building standards.

•**Carbon Credits**: Potential to earn carbon credits, adding a revenue stream.

🔹 **Improved Structural Integrity**

•**Durability**: Enhanced strength and resistance to environmental stressors extend the lifespan of structures.

•**Maintenance Reduction**: Decreased need for repairs and maintenance over time.

📈 **Carbon Credit Opportunity**

•**Average 1 ton of cement emits ~0.9 ton CO_2**

•Graphene-enhanced cement can cut this by **~0.35 ton**

•**1 Carbon Credit ≈ 1 ton CO_2 avoided = $25**

•If producing 1 million tons annually:

- **You save ~350,000 carbon credits**
- **Potential carbon revenue: $8.75 million/year**

"RI GROUP'S GRAPHENE INTEGRATION DOESN'T JUST ENHANCE CEMENT

IT TURNS A LIABILITY INTO AN ASSET BY CREATING STRONG, GREEN CEMENT READY FOR TOMORROW'S ECONOMY."

JOIN THE FUTURE OF CONSTRUCTION MATERIALS

PARTNER WITH RI GROUP TO COMMERCIALIZE GRAPHENE-BASED CEMENT.

- CONTACT US FOR PILOT SAMPLES, TECH SHEETS, OR BULK ORDERS.
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