

Graphene oxide reinforced concrete

Monash researchers, led by Dr Wenhui Duan, have discovered a novel method for reinforcing concrete construction materials.

They have developed a cementitious matrix with enhanced strength and durability through the incorporation of graphene oxide (GO).

Ordinary Portland Cement (OPC) is widely used in the construction industry. However, to overcome its poor tensile properties and to delay the development of micro-cracks, it must be reinforced with steel bars and various fibres may be added.

Applications

- Conventional buildings and infrastructure utilising precast or cast-in-place products
- Offshore and other structures in marine environments
- Well cementing
- Smart materials for structural health monitoring

Advantages

- Higher compressive and tensile strength
- More durable
- Corrosion resistance

Technology

When GO is included in OPC compositions, the matrix materials produced exhibit significantly improved mechanical and physical properties. The composition is normally produced by dispersing GO sheets in water without the inclusion of dispersant, surfactant or stabilizing agents, and then mixing the dispersion with

cementitious material. Alternatively, compositions can be produced by adding GO at the time of mixing the cementitious material, liquid, aggregate and other conventional additives.

Laboratory tests show that only 0.05% of GO is needed to improve flexural strength of an OPC matrix from between 41% to 59% and compressive strength from between 15% to 33%.

The addition of GO also improves the ductility and reduces the likelihood of sudden failure of concrete, with GO-OPC samples displaying a broader stress-strain curve within the post-peak zone (Figure 1).

Laboratory tests also show that the addition of 0.05% GO improves pore structure and decreases total porosity from 32.6% to 28.2%, providing higher compressive strength and a more durable product.

The addition of GO improves the degree of hydration of the cement paste and increases the density of the cement matrix, creating a more durable product.

Opportunity

Industry partners are sought for further development of this technology with a view to licensing and commercialisation.

Patent status

The technology is owned by Monash and is protected by PCT/AU2012/001582.

Figure 1

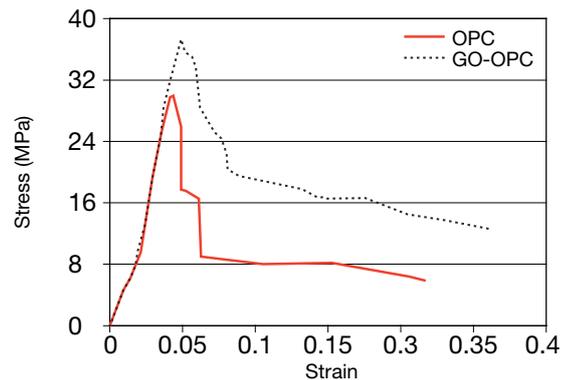
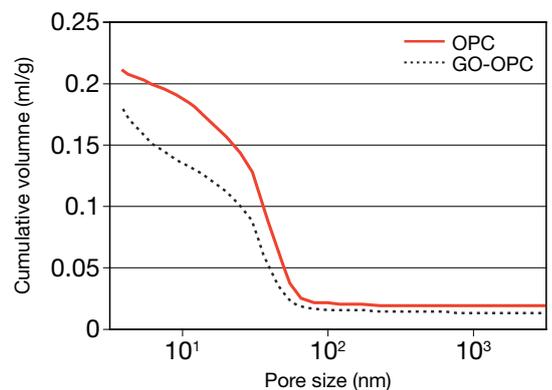


Figure 2



Comparison of mechanical parameters of graphene oxide reinforced cement (GO-OPC) and OPC; the compressive strength of cement paste is 46% higher and the microstructure of cement paste is finer and denser with the inclusion of GO sheets.

Contact us

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