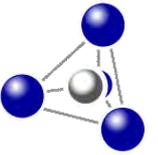




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Nano and Advanced Materials Institute Limited

Geopolymer Camp 2016



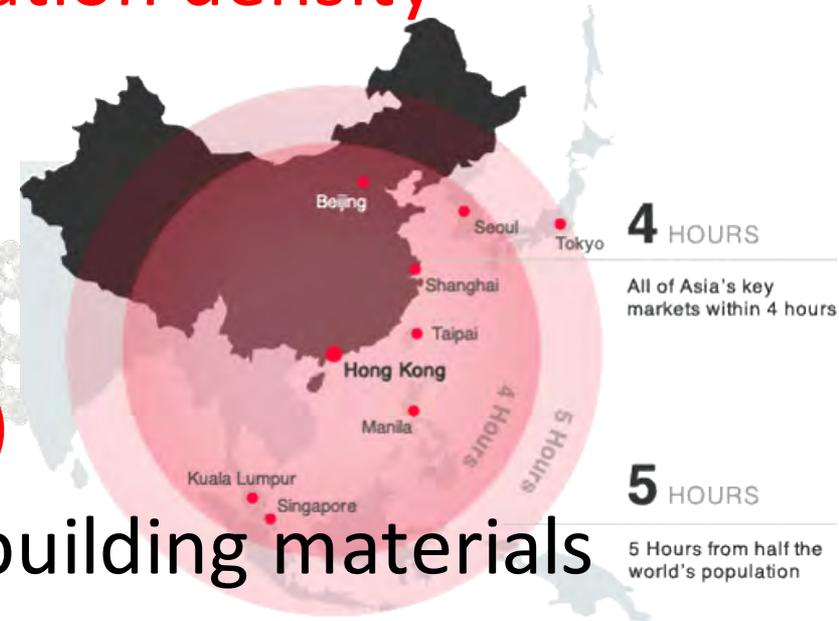
# Development of Geopolymer Technologies in Hong Kong

Simon GUAN

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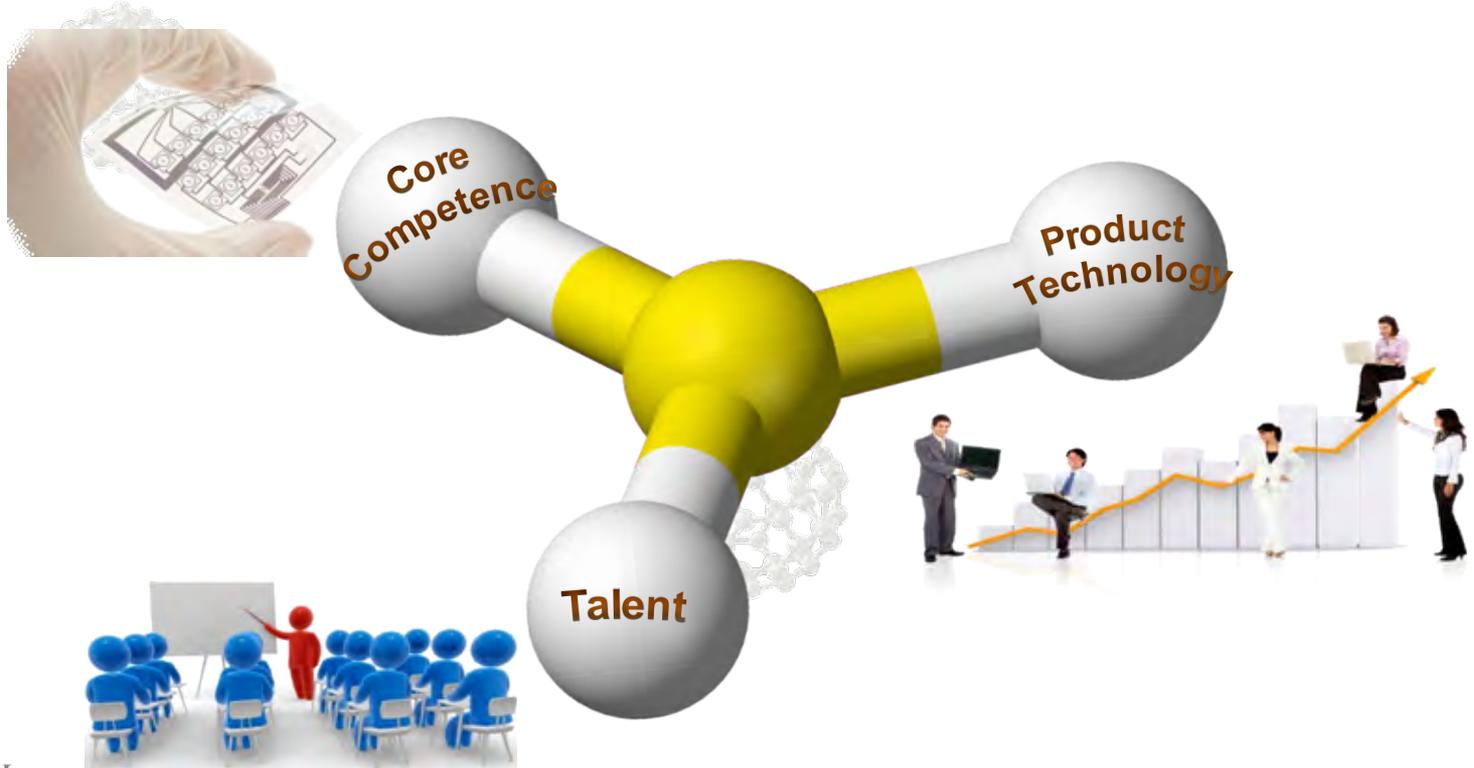
# Why Hong Kong?

- Strategically located at the heart of Asia, and alongside **most exciting material markets**
- Abundant feedstock supplies from China, such as metakaolin, fly ash, slag, etc.
- Almost the **highest population density**
- Renowned worldwide **financial center**
- Legal protection of **intelligent properties (IPs)**
- **Opportunities** for “new” building materials

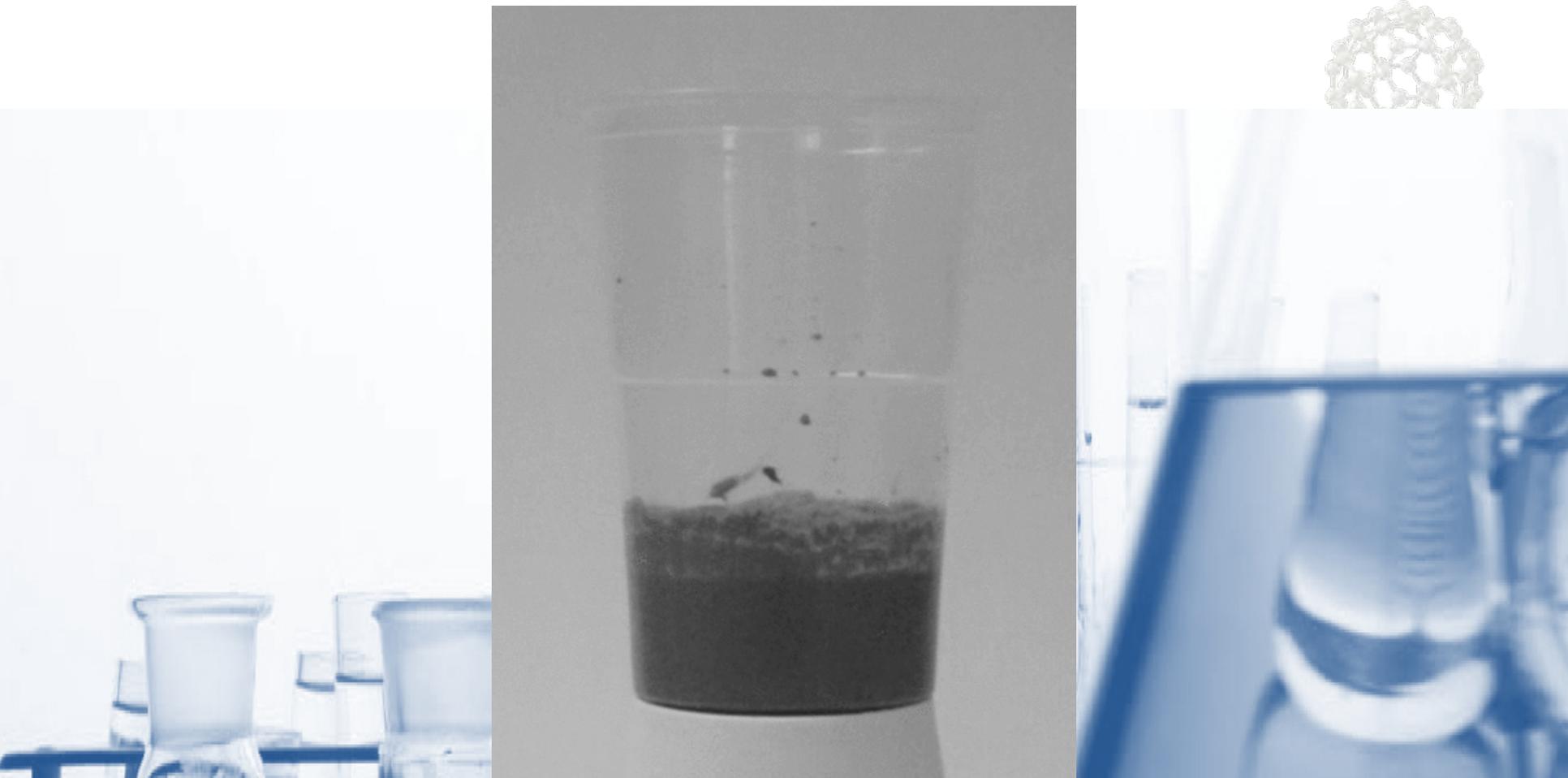


# NAMI – an Applied Research Centre

- NAMI is established in 2006 by HK Government
- Part of the Applied Research Eco-system
- Offer technology upgrade to HK industries



# Let's Grow with Geopolymer



The foaming of geopolymer (density  $\sim 0.2$ ) at NAMI

# Why Foamed Geopolymer?

- **Excellent performances** match the modern building technology

- Lightweight yet high strength
- Lower thermal conductivity
- Higher sound insulation level

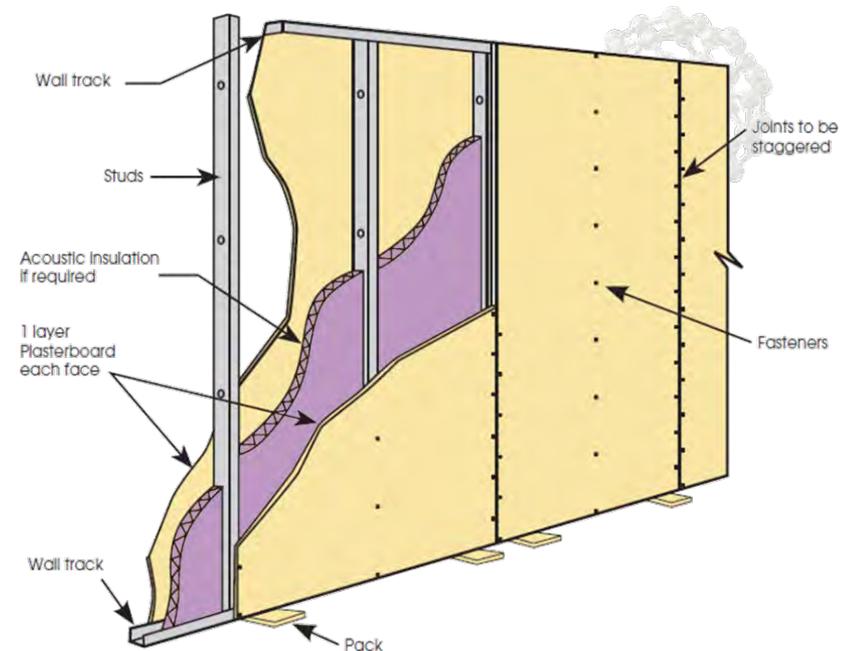


- Fresh foamed geopolymer (FGp) is also **pumpable** and being formed in any shape on-site



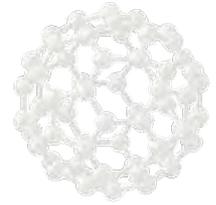
# Assembled Partition System

- Advanced partition wall becoming the new focus of modern building
- Sandwiched structure w/ foamed Geopolymer
- Excellent performance in **acoustic & thermal** insulation, **fire resistant**
- Heavy duty partition with **impact strength & high load carrying** capacity



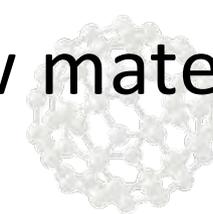
# NAMI's Foaming Technologies

- Physical foaming
  - **Ready-mixed foam** as a mixture ingredient
- Chemical foaming
  - **Foams generated within** the paste/mortar
  - Foaming agent such as aluminum powder,  $\text{CaH}_2$  or  $\text{H}_2\text{O}_2$  etc. added in & well mixed
  - More suitable for **ultra-lightweight** pre-cast panel



# The Challenges

- Targeting performances
  - Density ( $< 180 \text{ kg/m}^3$ )
  - Compressive strength ( $> 0.3 \text{ MPa}$ )
  - Thermal conductivity ( $< 0.055 \text{ W/mK}$ )
- Introduction of **controlled air voids**
  - **Generation, size, stability & dispersion** of the foam
  - Proper **foaming agent** & mixing procedure
- Matrix design and raw materials selection
  - **Binding** materials
  - **Functional additives**



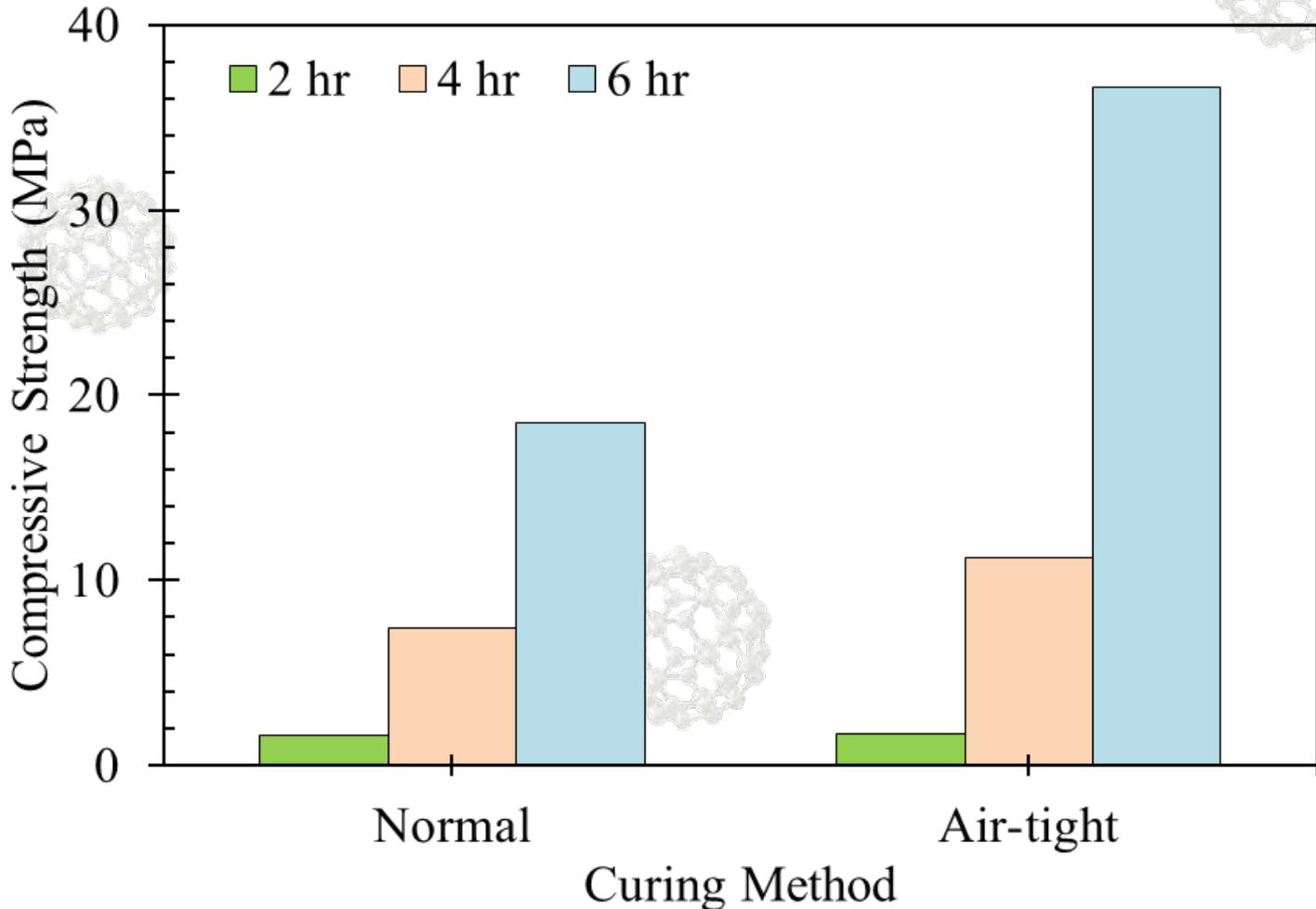
# The Green Alternative

- Made of **industrial by-products** such as ground granulated blast furnace slag & fly ash 
- **Green** technology to replace OPC
- Unique features of geopolymer
  - **Rapid early strength**
  - **Acid resistant**
  - **Cost effective**
- A **win-win solution** to the industry & environmental issues 



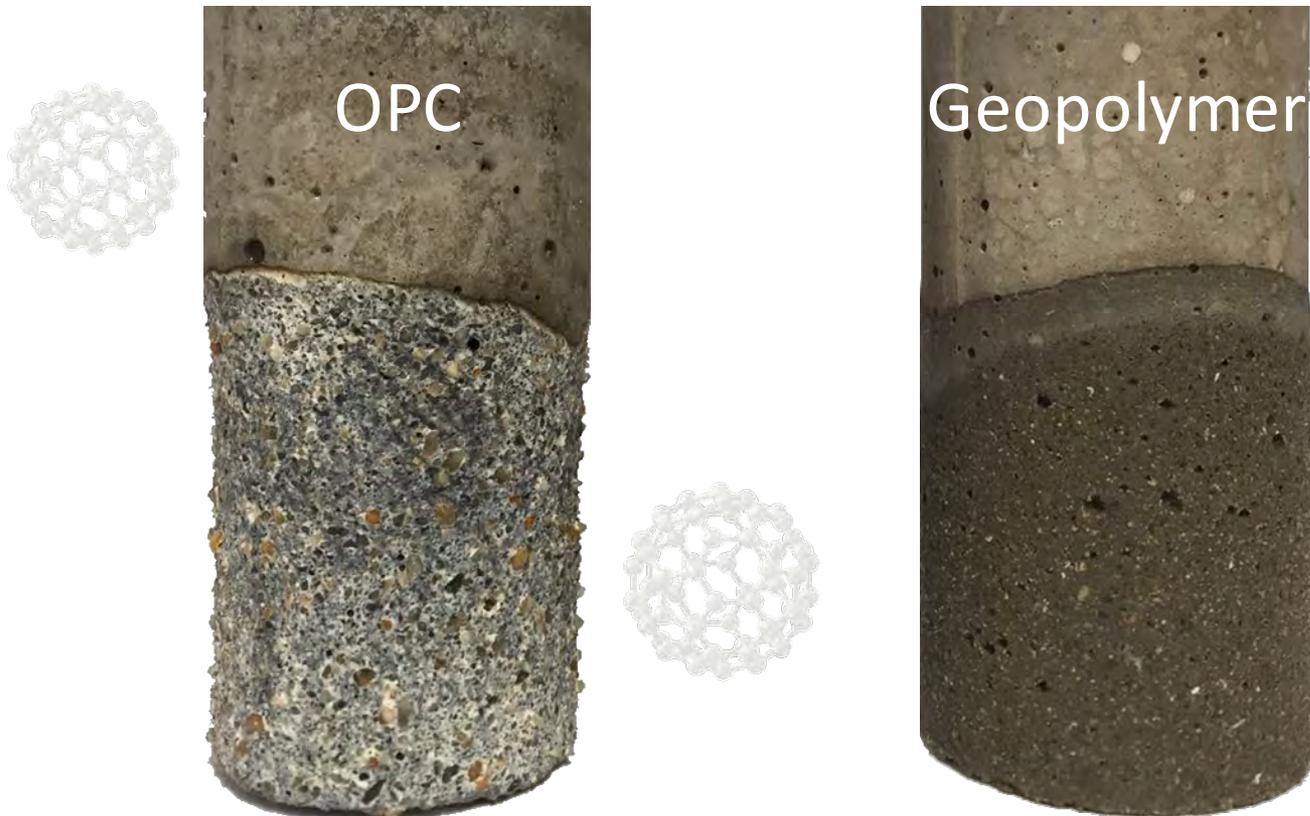
# Early Strength for Rapid Repair

- Facility can be re-opened within hours



# Excellent Acid Resistance

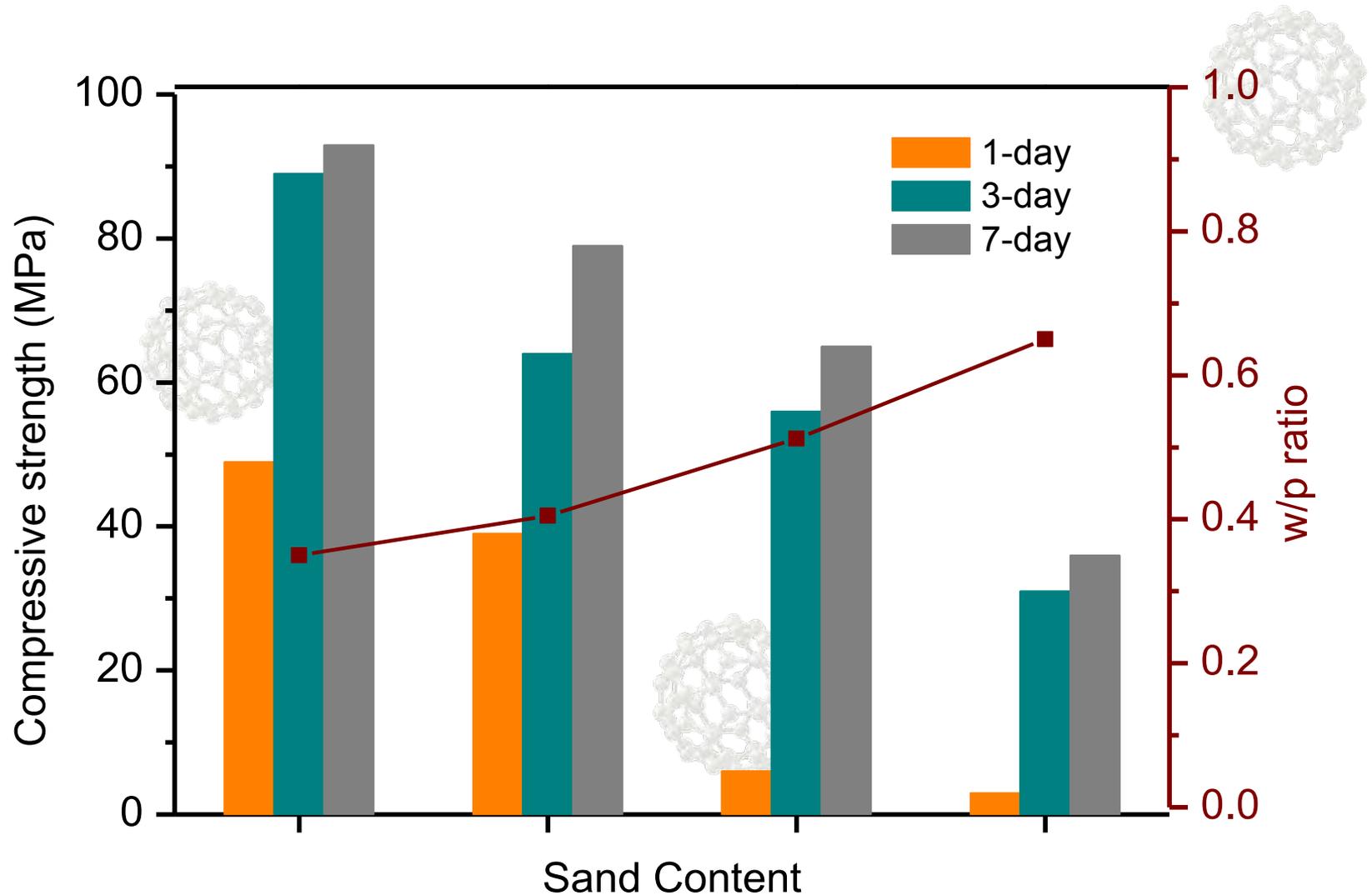
- Dynamic partial submersion in 5% sulphuric solution (pH~0.5) for 14 days



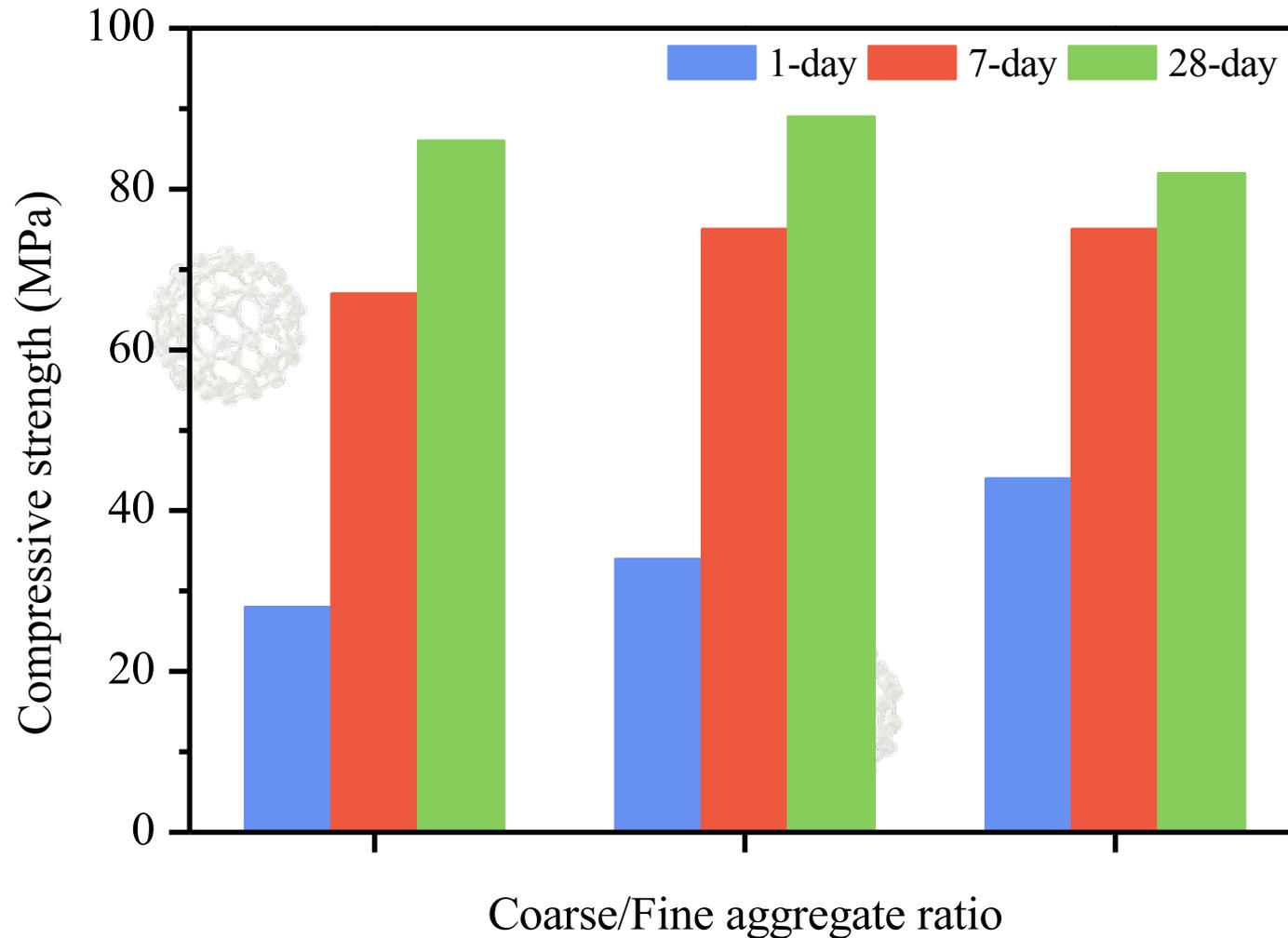
Weight loss over 6%

Not measurable

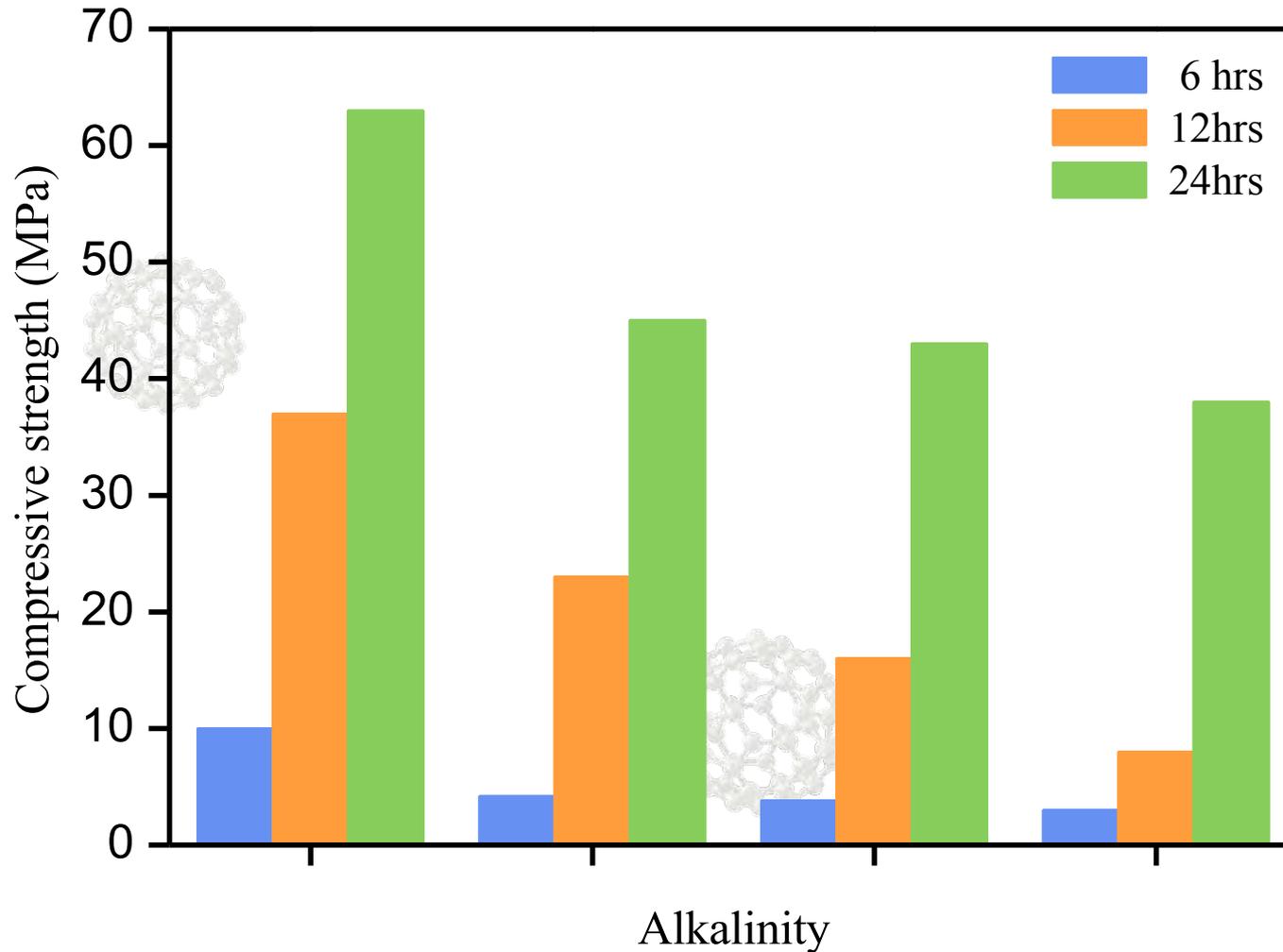
# Effect of Fine Aggregate



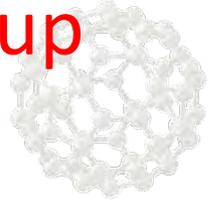
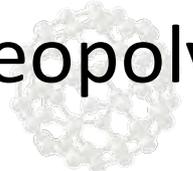
# Effect of Coarse Aggregate



# Effect of Alkalinity



# Our Missions

- **Formulation research** of FGp and **scaling-up** from laboratory to mass production 
- Development, commercialization & promotion of Geopolymer 
- **Collaborations** with universities/ institutes and industries are welcome
- **Graduates** with related background are strongly **welcome to join us** 



# Thank You Very Much!

## 納米創意無止境

