

# Abdelrahman Alshouha

## PhD candidate in engineering and information technologies

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### Research topic and interests

- Development and characterization of concrete-based sensible thermal energy storage (TES) systems for high-temperature applications, with a focus on improving thermal conductivity, thermal performance, and durability.
- Research interests include:
  - ✓ Development of innovative concrete formulations.
  - ✓ Incorporation of thermally conductive materials.
  - ✓ Optimization of concrete geometry for thermal energy storage applications.
  - ✓ Transition from laboratory-scale testing towards application-oriented validation and industrial implementation of concrete-based TES systems.
  - ✓ Characterization of thermal performance under high operating temperatures.

### Current work

- Development of concrete thermal energy storage elements for high-temperature operation.
- Experimental investigation of concrete formulations incorporating additives to enhance thermal conductivity.
- Development of a continuous path within concrete to improve heat transfer while minimizing concrete cracking.
- Experimental testing using air as the heat transfer fluid (HTF).



### Key areas of expertise

- ✓ Concrete formulation and applications: design and optimization of concrete mixes for high performance, durability, and sustainable construction applications.
- ✓ Multifunctional cementitious composites: development of cement-based materials with combined structural, thermal, energy-storage, and durability functions
- ✓ Sustainable and low-carbon construction materials: development of eco-friendly materials using low-carbon binders, recycled resources, and industrial waste to reduce environmental impact.
- ✓ Concentrated solar power plants (CSP) and High-Temperature TES: development and optimization of high-temperature thermal energy storage systems for efficient energy storage and dispatch in CSP plants.
- ✓ Sensible TES: development and characterization of materials and systems for storing thermal energy through temperature variation for efficient heat storage and recovery.

### Results

- ✓ Refractory concrete developed up to 1000 °C.
- ✓ Hexagonal TES elements successfully developed.
- ✓ Mechanical integrity maintained using wool fibres.
- ✓ Continuous pathways developed for improved heat transfer.
- ✓ Elements prepared for high-temperature testing with air HTF.



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