MATERIALS SCIENCE AND PROCESS ENGINEERING

with Dr Theodore Hanein

Talking *points*

KNOWLEDGE

1. What is the circular economy?

COMPREHENSION

2. Why is cement necessary for society?
3. Why is the generation of CO_2 an issue for society and for the cement industry specifically?
4. Cement manufacturing is considered one of the most challenging major industries to decarbonise. Why do you think this is?

APPLICATION

5. Portland cement is typically designed to last for decades. How do you think Theo's team can determine the lifespan of ferrite-rich cement within a few years?
6. How do you think minerals generated from the mineralisation of CO_2 (as a method of CCS) might be used by the construction or mining industries?

ANALYSIS

7. Theo mentions the electromagnetic properties of ferrite-rich cement as apossible benefit. What would be the advantages of this? Think about the entire lifespan (production, use, deconstruction) of cement.
8. Why do you think Theo considers CCS to be only a short-term solution to global decarbonisation?

EVALUATION

9. Even when supported by strong evidence, scaling up innovative processes often faces barriers. What practical, economic and political obstacles do you think might stand in the way for the rollout of innovative cement production methods? How might these be overcome?
10. To what extent do you think a true circular economy is a realistic goal for the future? What are some of the obstacles to achieving this? What benefits (direct and indirect) might a circular economy bring to society?

Activity

Establishing the underlying science is only the first step in changing an industrial process. Imagine you are working on Theo's FeRICH project and have discovered how to optimise the manufacture of ferrite-rich cement and its benefits as a construction material. Now, your job is to communicate these findings to stakeholders, who include:

- Cement manufacturers
- Steel manufacturers
- The construction industry
- Policymakers who:
  - Create rules and legislation for industry practices
  - Manage public spending to help the government reach its climate targets

Imagine you are presenting to a mixed group of these stakeholders. Design a presentation that powerfully conveys:

- The benefits of your findings to each stakeholder group
- The benefits of your findings to national and global society
- How the stakeholders should work together to take a joined-up approach to change
- Implications for the circular economy
- Suggested immediate next steps
- Start and end with a key 'take-home message'

Give your presentation to your class or group. Encourage them to take the role of a particular stakeholder and ask relevant questions. Once finished, reflect on your presentation. Did you meet all the objectives above? Were there any unexpected questions? Would you do anything differently if you were to do it again?

More *resources*

- This video features Theo explaining his current projects and scope for collaboration between the UK and India. It provides an interesting insight into the practicalities involved in research for industrial processes: **vimeo.com/680947095**

- This animated video from the Ellen MacArthur Foundation provides an introduction to the intriguing concept of the circular economy and what it could mean for the future of society: **www.youtube.com/watch?v=zCRKvDyyHml**